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Engineering News-Record

What Car Owners Should Pay for Road Building

By A. R. Hirst

Building Six-Mile Moffat Tunnel Through the Rockies

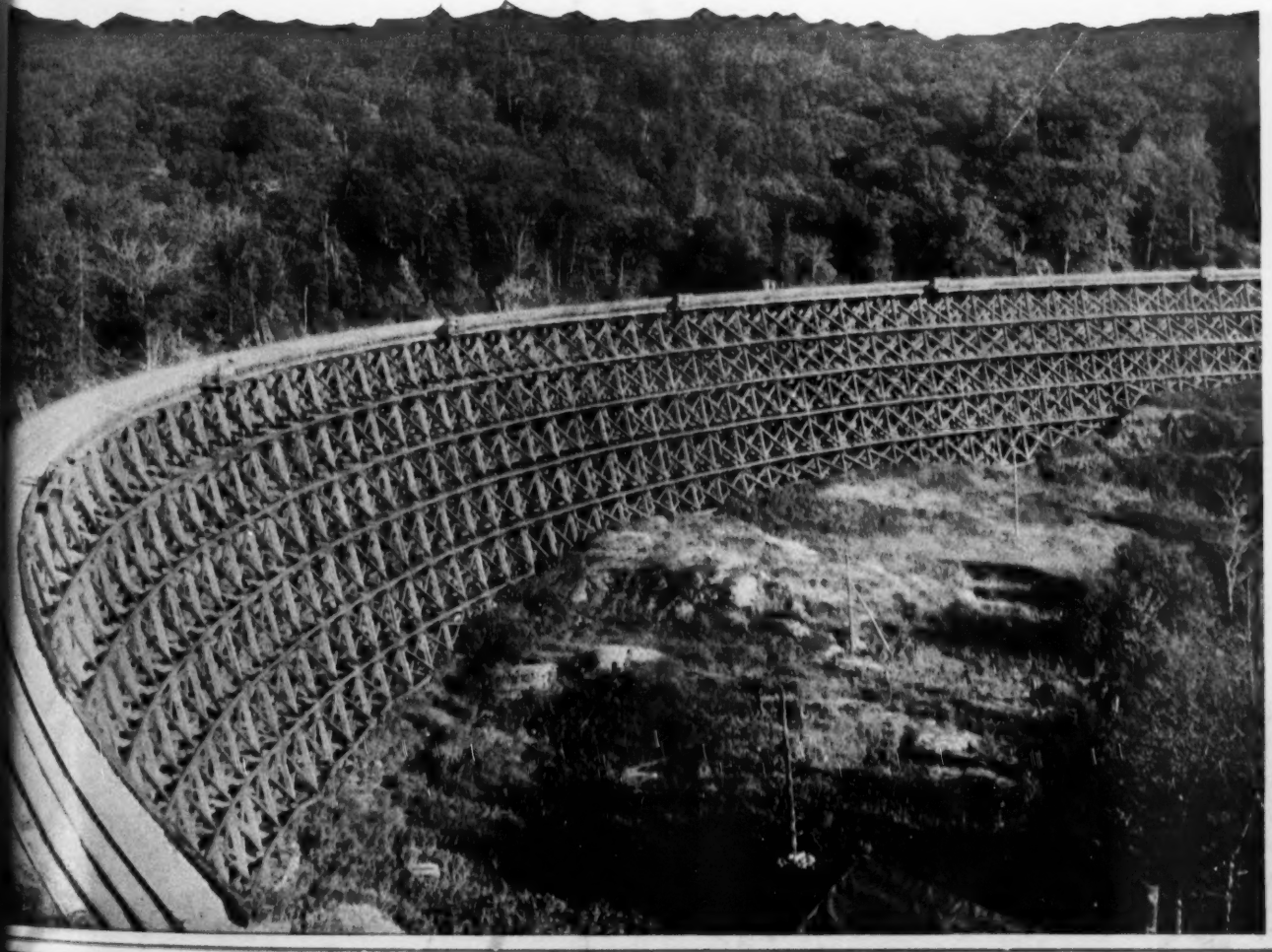
Faults of Reclamation Law and Practice and Their Remedies

By Thomas H. Means

Relocation Avoids Large Trestles and Sharp Curves

Also: Several Pages of Job and Office Hints

A Thousand Feet of 12-Degree Curve on a Canadian Trestle



A plant deserves a roof even better than its walls

Suppose the slim reward for the trouble and expense of erecting a new plant was the dismal prospect of rebuilding the foundation, floors, and walls after a few years!

—But of course that is not the outlook of the modern plant, and the chief reason for this is *concrete*—concrete walls, concrete foundations, concrete floors and walks.

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ENGINEERING NEWS-RECORD

DEVOTED TO CIVIL ENGINEERING AND CONTRACTING

E. J. Mehren, *Editor*
Frank C. Wight, *Managing Editor*

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Write Your Congressman

NO FISCAL proposal of recent years has caught the attention of the country as has Secretary Mellon's tax reduction plan now before Congress. Backed by the President's strong indorsement this recommendation for a kind of taxing that will relieve the middle class directly, and the great body of the untaxed indirectly but no less surely, has become the leading issue before Congress. The soldiers bonus and the desire to penalize the very rich stand in the way of favorable action but Congressmen, after all, want to do what they think their constituents want. Now is the time for every citizen, whether or not he has ever done such a thing before, to write his Congressman and urge upon him the justice and desirability of the Mellon plan. A vociferous minority can only be overcome by an equally vociferous majority.

Remaking the Railroads

THE preliminary reports of the various committees on transportation of the Chamber of Commerce of the United States are most promising of an informing conference next January. When groups of business men in all lines of activity get together on a problem of such common interest an awakening of thought is bound to result and at the present juncture solid thinking by a number of people is the most necessary preliminary to any discussion of the railroad question. The business men of the country can not remake the Transportation Act but they can activate Congress to a sane considera-ation of any such remaking as will be proposed.

Transit Benefit Assessments

WHILE everyone knows that raising money for public works is frequently more difficult than building them, the emphasis given to this fact in the report of Detroit's rapid-transit commission is decidedly noteworthy. Details such as planning the system of routes or designing structures are boldly put to one side in the report, and the commission asserts that until the basic question of a financial plan is decided there can be only harm in proposing routes or designs. A very large sum of money will be needed to provide Detroit with rapid transit, while the city's available bond-issue capacity is so small that it would hardly build a mile of line. This constitutes the problem. The commission proposes to solve it by assessing the benefits on the property adjacent to the lines. Benefit assessment would have the double advantage of preventing the piling up of a burden of overhead on the taxpayer, and collecting for the public benefit a share of the unearned increment created by the public improvement. As a solution of the bond-limit difficulty the method has immediate interest to many cities besides Detroit. Probably every city that is thinking of rapid transit has the same problem of needing more money than its financial resources can supply; and to a certain degree this remark might be extended beyond the field of rapid transit. If judicious application can be made of the principle of placing the cost of such works on local benefits, the way will be clear to do much badly-needed municipal work at present held in abeyance by lack of funds. The justice of the method—again, where judiciously applied—is its special recommendation. In a very similar and fully as interesting a case, that of the Moffat tunnel, which is also described in this issue, the test of Supreme Court interpretation has been obtained in favor of the method.

Coal Stock Piles Control the Price

THE striking relation between the reserve in consumers' stock piles and the spot price of coal is emphasized by the Geological Survey's report on the economic phases of coal storage. The report presents two charts, one a curve of the spot price of coal and the other a mass diagram of consumers' stocks. Separately the charts do not show much, but when superimposed it becomes evident immediately that every time stocks have fallen below 30,000,000 tons the price has immediately increased and when they have fallen below 20,000,000 tons the market has been thrown into a state of panic. Production in itself is not the controlling factor, for times of high production have frequently been marked by high prices due to consumers' nervousness over their lack of reserve. The lesson is evident. Consumers collectively can control the market. The individual can profit to the full from a policy of storage by storing more coal than his neighbor. Then, when his neighbor is in distress and is bidding up the price to scarcity levels, he can stay out of the market. If he stores less than his neighbor, he will have to enter the market first and will be there when the price is at its peak. Consumers, either individuals or concerns, should not begin to use their reserves while the price is normal. Instead, they should continue to buy for their current needs until prices become abnormal, when they can fall back on their reserves. Such a policy will give them the full benefit of their reserves, and will, at the same time, insure their not having to enter the market until after the peak has passed.

Minnesota Joins the List

MINNESOTA has gone as far as the law allows in disapproving, through its State Board of Health, plans for the direct-oxidation or lime-electrolytic process of sewage treatment submitted by the city of Austin. In this it comes as nearly as it feels it legally can to following the action of the New Jersey Board of Health which has refused permits for the same process to Phillipsburg and Trenton. Ohio is still delaying action on the Lima plans for the direct-oxidation process. The engineering division of the Provincial Board of Health of Ontario has for months past been running

parallel tests of limed sewage passed (1) through an electrolizer and (2) directly to a sedimentation basin. In Pennsylvania it appears that the Allentown plant has been given a conditional approval but that the state health authorities are waiting for enough sewage to reach the plant to permit a full-capacity test of one of three 1-m.g.d. units completed some two years ago. In view of conditions elsewhere the action of the Minnesota Board of Health is not surprising. The opinion of the Minnesota attorney general, noted elsewhere in this issue, suggests to us the question, should not the authority vested in a state board to approve or reject plans for sewage-works be accompanied by power to exclude from the plans any expensive element of undemonstrated value, even though that element may not be detrimental to the end result of the whole process? Whatever the answer may be when viewing the question in its relation to the police power of the state, sound economics demand protection to the municipal treasury. Assuming that any state board of health lacks the power to prevent the expenditure of money on unproved processes then the least that it should do is to point out clearly what the risk is—as the Minnesota board has done.

A Time for Tribute

TWENTY years ago next Monday man made his first successful flight in a heavier than air machine. It will be worth while for every one that day to pause and give thought to those two persistent Dayton shopmen who first flew their little fluttering plane over the Carolina sand dunes on Dec. 17, 1903. The airplane has by no means revolutionized the world but it has removed just so much further man's limitations and whatever does that, whether it be the alphabet, or the steam engine or radio, makes life just that much more worth living. The Wright brothers did not develop the airplane out of nothingness but they had the true inventor's instinct of persistent experiment with those things their predecessors had already made known and the faith in their own ability to do what no man had done before. Those of us whose horizon—both spiritual and actual—has been enlarged by their genius can do no less than pay them the tribute of a moment's remembrance.

No Progress

A LITTLE less than two years ago it appeared certain beyond doubt that a step forward would be made in the long struggle against bad building. The evil results of bad building had just become manifest in shocking manner. The roof of the Knickerbocker moving-picture theater in Washington had fallen down during a performance, crushing nearly a hundred of the spectators to death; only a few weeks earlier half a dozen men had been killed in the collapse of an uncompleted moving-picture house in New York, to be known as the American. There was evidence of flagrant violation of sound practice in the planning and erection of the buildings. Universal alarm and indignation arose over the tragic failures. But these feelings were tempered by the belief and hope that the inevitable judicial prosecution and due punishment of those involved would have the effect of discouraging the continuance of bad building practices. Events of the past few days, however, seem to have finally disappointed this hope. Prosecution of the owner and contractor in the American case failed, the trial judge vacating the indictments for technical defects. Almost simultaneously the trial of several damage suits against the owners of the Knickerbocker theater by relatives of victims reached an equally disappointing end, with verdicts in favor of the owners. Long before this the criminal prosecution of the parties to the Knickerbocker job was ended, when a judge voided the indictments and the district attorney then refrained from attempting to bring new indictments. In the face of such a record it is not possible to feel satisfied with the operations of legal process. But—to think of the future—it is necessary to realize the hard fact that the sacrifice of a hundred dead has not brought us nearer to sound building, and that the fight of past years must continue if we are to stay the arm of the incompetent, the neglectful, and the fraud.

Increased Motor Vehicle Imposts

WHAT should the car owner pay as his share of the cost of highway improvement? Answers range between a moderate charge sufficient to maintain improved roads and the total cost of road construction and upkeep. The dispute wages endlessly.

Meanwhile the people everywhere, through acts of legislature, are adding to the taxes on the car user. This year one state, Utah, has radically reduced motor vehicle license fees and one, New Hampshire, has revised its license fees slightly downward, but in every other state where there has been any change it has been an increase. This year also 32 states have placed a tax on gasoline or raised the existing tax until now 37 states impose taxes ranging from one cent to four cents a gallon. Gas taxes barely failed of enactment, generally by veto, in half a dozen other states.

Two facts are obvious in all automobile legislation, that which failed and will again come up for consideration and that which was enacted: (1) The public has determined that the car user shall pay largely for road improvements and (2) the public is convinced that heretofore the payment has not been as large as it in justice should be. This brings us again to the original question: What is a fair payment?

Recently A. R. Hirst, state highway engineer of Wisconsin, has undertaken to answer this question with mathematical precision. He has evolved a formula, published in another column, for computing the charge against car owners for highway service. According to this formula the charge at present is about half of the amount it should be. This charge, Mr. Hirst proposes, should be made in the form of license fees and a tax on gasoline consumption which is held to be the best measure of road use by motor vehicles. It is not, however, in the character of the imposts proposed by Mr. Hirst that concern will lie but in their magnitude. He suggests a minimum of five cents and a maximum of ten. He will have his critics and they will not be kind.

Fundamentally, however, the question is not rates but whether the automobile should pay a greater share (about twice as much) than it is now paying of the cost of road service. As Mr. Hirst points out we cannot let thought of what has been hamper our conclusions. Roads are improved today for motor vehicles. Not a thought in design or construction of the modern main road is for other than motor vehicle service. It is the user who must pay. And with 14,000,000 motor vehicles being used the payment has to be large.

Another Industrial Message

FEW messages to Congress have had more intrinsic importance than the one President Coolidge has just delivered. As a program which this Congress will follow it has only the force of the executive desire, which this year is not commanding because of the closeness of the party representation in Congress and the uncertainty of the action of the so-called insurgent group from the Middle West. But as an indication of the political faith of one of the leading candidates in the coming Presidential election the document becomes practically a party platform, besides being a revelation of the mind of one who for excellent reasons has not thought it fitting since he became a national figure to express an opinion on our national problems.

The message is curiously revelatory of the Coolidge psychology. To a people accustomed to the rather turgid rhetoric of presidential messages, this one at first reading seems deadly dull. There seems to be no emphasis, no high spots or clear call to action. It requires a second reading to get the tone of the message, to realize that it is a model of compression with few waste passages and that the mere mention of a subject is in itself an emphasis of that subject. One sentence—paragraphed by itself, and all there is on a most disputed issue—"But I do not favor the granting of a bonus," is more expressive than pages of argument. Unless the character analysts of the press are all wrong this means that those congressmen who think they were elected on a pledge for a bonus will have occasion to vote twice on that question—before and after the Presidential veto.

Reading the message, then, as the framework of an administration policy and a platform for a candidacy, we note the same insistence on industrial problems which has marked the presidential messages of recent years. The old issues, particularly the currency and the tariff, are hardly noted. In their stead are taxes, the railroads, the farmers, national improvements and coal—and all of these are either directly industrial or have repercussions of the greatest moment in industry. In two of these sections, on taxes and the railroads, the message is strong and commendable. On the others it tends too much toward generalization where a definite stand might have been expected.

The President comes out flat-footed for the Mellon plan of tax-reduction and in so doing hammers home the too frequently forgotten axiom that lowered taxes benefit those who do not pay a direct tax quite as much as those who do. In characteristic short sentences he says: "For seven years the people have borne with uncomplaining courage the tremendous burden of national and local taxation. These must both be reduced. The taxes of the nation must be reduced now as much as prudence will permit, and expenditures must be reduced accordingly. High taxes reach everywhere and burden everybody. They bear most heavily upon the poor. They diminish industry and commerce. They make agriculture unprofitable. They increase the rates on transportation. They are a charge on every necessary of life. Of all services which the Congress can render to the country, I have no hesitation in declaring this one to be paramount. To neglect it, to postpone it, to obstruct it by unsound proposals, is to become unworthy of public confidence and untrue to public trust. The country wants this measure to have the right of way over all others." This is sound doctrine, but it is one that needs the strong hand of the executive to back it up.

Concurrent with the demand for lower taxes runs a reiteration of the Harding policy for an adherence to a federal budget and a plea for a constitutional amendment against tax-exempt bonds. The President will probably be able to carry the budget through against the congressional forces who fight any reduction of their prerogatives but the possibility of the states depriving themselves of tax-exemption seems quite remote.

Much is said in the few paragraphs on the railroads and most of it is good. There is a rather timorous defense of the Labor Board, to be sure, but the plea for a continuation of the Transportation Act is excellent. The onus of the complaints against that act lie in the interpretations of the term "value" by the courts and the Interstate Commerce Commission and not in the "fair return" clause of the act itself. The President well says that "unless the government adheres to a rule of making a rate that will yield a fair return, it must abandon rate-making altogether." A government activation of consolidation, as suggested in the message, offers the best promise of general rate relief, though the recommended general reorganization of the rate structures is imperative as a means to early adjustment of unfair conditions.

The message adds nothing to the solution of the coal or of the immigration problem. Both passages are fair enough statements of the issues but on neither does the President indicate a way out. The same might be said of his comments on the great national improvements, though the adherents of the St. Lawrence waterway and power scheme may find some encouragement in his comments on that project. The real Muscle Shoals issue—that is the legality and fairness of the Ford 100-year amortization offer—he avoids entirely though he does intimate that there should be a much more reliable promise of fertilizer manufacture at Muscle Shoals than Mr. Ford has ever made. On all these questions the expressions do not have that clear promise of future policy that would have been welcome.

On several other questions of interest to engineers the message is short but, remembering the general tone of the document, quite satisfactory. The administration favors highway development and reforestation and a proper departmental reorganization, minus the impossible Army-Navy combine. In reclamation, the necessity for some readjustment of charges is recognized but no encouragement is offered for complete repudiation. The only other two major sections of the message, those on foreign relations and on agriculture, have at least a collateral industrial importance for nothing would contribute a greater measure to industrial stability than a settlement of the difficulties in Europe and an alleviation of the depression in agriculture. In discussing both of these subjects the President takes refuge again in the concise statement of fundamentals which may mean much when interpreted by future action but which lacks something as a guide to what that future action must be.

It is clear that the big national problems, as selected by the President of the United States, are mainly industrial. Let the engineers of the country in reading the message note that fact, and in so noting recall the responsibility they have of educating their less interested fellow citizens as to the fundamentals of industrial needs.

Six-Mile Moffat Tunnel Through the Rocky Mountains

Novel Plan to Finance Railway Tunnel Replacing Open Summit Pass—Small Parallel Pilot Tunnel Assists Construction—Excavation Progress to Dec. 1

AN IMPORTANT step both in tunnel work and in the development of railway transportation facilities was taken in the recent award of a contract for constructing the six-mile Moffat Tunnel through the Continental Divide, about fifty miles west of Denver, Colo. In several ways this enterprise is of exceptional interest: (1) The tunnel will be of unusual length; (2) intermediate headings are to be driven from connections with a parallel heading or pilot tunnel; (3) the tunnel is to be built as a public work for improving the railway system of the state; (4) funds are to be provided by an improvement district established by law for this purpose and authorized to issue bonds; (5) the pilot tunnel may be utilized for a water conduit giving the city of Denver a new supply from sources on the west slopes of the range. A plan and profile of the line are shown in Fig. 1.

History of Tunnel Project—A tunnel under James Peak was proposed originally by the late D. M. Moffat, promoter and president of the Denver & Salt

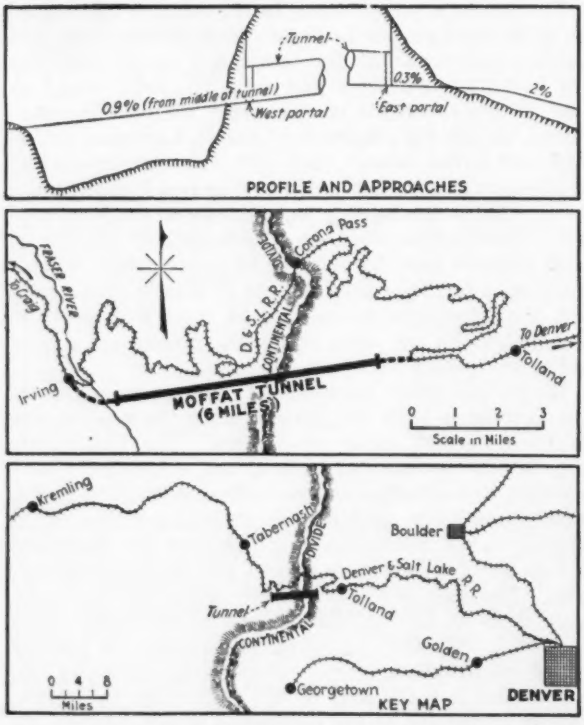


FIG. 1—MAPS AND PROFILE OF MOFFAT TUNNEL LINE

Lake R.R. This line was intended to be a specially favorable link, with maximum grades of 2 per cent, in a transcontinental route through Colorado, but also to develop a rich agricultural and mineral district far from existing railroads. Pending the construction of the summit tunnel at about El. 9,200, an open line was built having long grades of 4 per cent and numerous curves of 16 deg., with curvatures forming a heavy proportion of the total length. This line crosses the summit in Corona Pass, at El. 11,660. Financial conditions have prevented the building of the tunnel and the completion of the railway to its western connections at Salt Lake City. The present line extends 255 mi. from Denver, El. 5,170, to Craig, Colo., El. 6,175. Its heavy grades, high altitude and snow troubles at the crossing of the Divide are seriously detrimental to operating efficiency and economy. When completed, the Denver & Salt Lake R.R. will give a route of about 565 mi. between Denver and Salt Lake City, as compared with 620 mi. by the Union Pacific R.R. and 745 mi. by the Denver & Rio Grande Western R.R. It has been suggested that in advance of the completion of this new railroad a 40-mile connection from McCoy, on the Denver & Salt Lake R.R., west of the tunnel, to Dotsero on the Denver & Rio Grande Western R.R., would give a combination route of about 600 miles.

In view of the potential importance of a new railroad with a low-grade line across Colorado, both for local development and as a favorable transcontinental route, various attempts have been made to provide public assistance for the tunnel project. In 1913, the city of Denver adopted an amendment to its charter authorizing the issue of bonds and the creation of a commission to build and operate a tunnel. This commission entered into negotiations with the railroad and recommended a bond issue of $3,000,000. The railroad was to pay the remainder of the cost, which was estimated at $4,200,000. The tunnel was to be large enough for a water conduit and was to be available for use by any other railroad on payment of trackage rights and a share of the annual interest on investment. This project was noted in *Engineering News*, Jan. 29 and July 16, 1914, pp. 222 and 156. In February, 1914, the bond issue was carried by a large vote; but in July, 1914, the Colorado Supreme Court decided that the city had no right to issue bonds for this purpose.

The next attempt was to have the tunnel built as a state enterprise to be used by all Colorado railways having transcontinental traffic, since it would provide a route much more favorable than that of any other line across the state. In 1918, the Colorado legislature passed a law providing for a railway commission to study the situation and for a referendum vote on a constitutional amendment to authorize a bond issue for a tunnel. This commission recommended an issue of bonds for $18,550,000 for the Moffat tunnel and for two smaller tunnels on other routes considered to warrant improvement in the interests of the state. It has been suggested that this extension of the original project, with the large sum involved, led to disapproval by public opinion. At any rate, the proposed bond issue was defeated by referendum vote in November, 1920. Particulars of this state-aid project were given in *Engineering News-Record*, April 8, July 1 and Dec. 30, 1920, pp. 716, 44 and 1302.

Plans for municipal and state aid having failed, a new and highly unusual method was then suggested in the way of providing funds by assessments in an "improvement district" benefited by the tunnel. This plan, similar to that of drainage and irrigation districts,

proved successful. Early in 1922 the Colorado legislature passed the Moffat Tunnel Improvement District law, providing for the organization of a district with authority to issue bonds. The law also provided for a tunnel commission and limited the cost of the work to $6,720,000.

This third method, outlined in *Engineering News-Record*, May 18, 1922, pp. 811 and 836, received public approval. Further delay was caused, however, by a dispute as to the constitutionality of the bonds. In a friendly suit to settle this point, the favorable decision of the courts closed the preliminary and promotional stages of the tunnel scheme. Plans were then completed and proposals were invited twice on account of irregular bids in the first case. Finally, in September, 1923, the contract was awarded on terms as noted in *Engineering News-Record*, Sept. 27 and Oct. 11, 1923, pp. 532 and 615.

Description of Tunnel—According to the present plans the Moffat Tunnel will be 32,150 ft. in length, or almost exactly six miles. The east portal is three miles beyond Tolland, on the Denver & Salt Lake R.R., and the west portal one mile from Irving, these two stations being about 50 and 80 mi. respectively from Denver. The tunnel will be on tangent throughout. A grade of 0.3 per cent will ascend from the east portal at El. 9,198 to the summit at mid-length and at El. 9,242; thence on a grade of 0.9 per cent will descend to the west portal at El. 9,085. Maximum grades of 2 per cent are provided on the approaches, which are short and consist largely of fills.

The approximate quantities on which the bids and contract are based are given in the accompanying table:

QUANTITIES FOR MOFFAT TUNNEL

Railroad tunnel:	
Earth	200 cu.yd.
Rock	365,000 cu.yd.
Water tunnel, cross-cuts and main headings; rock	157,500 cu.yd.
Open cut:	
Earth	30,000 cu.yd.
Rock	15,000 cu.yd.
Concrete masonry in tunnel	5,000 cu.yd.
Permanent timber lining	1,000 M. ft. b.m.
Timber lining in water tunnel	160 M. ft. b.m.
Dry packing in tunnel	4,800 cu.yd.
Cordwood packing in water tunnel	250 cords
Steel pipe for grouting	200 lin.ft.
Cement	8,000 bbl.
Ballast in tunnel	15,800 cu.yd.

Excavation and Lining—That probably the entire work will be in gneiss rock was stated in a report of the State Geologist of Colorado in 1914. In section the tunnel as now proposed, for a single-track line, will have vertical sides, an arched roof and a flat floor, with a clear height of 24 ft. above subgrade and a clear width of 16 ft. in solid rock and 16½ ft. in timbered portions, as shown by Fig. 2. Complete timber lining includes 2-in. side lagging and 4-in. roof lagging, but in places only roof timbering may be needed, supported by posts or by wall plates. All spaces behind lagging are to be filled with loose rock, which will be grouted if required.

Concrete lining, which is expected to be used only near the portals, will be placed behind the neat line, the lagging being removed for this purpose. This concrete, proportioned 1:7, will be made by mechanical mixers. Pneumatic placing is permitted. If the rock breaks so high as to permit access above the arch after concreting, the arch will be given a definite thickness and the space above it filled with dry stone packing. Otherwise the entire space between the arch form and roof will be filled with concrete. Permanent timber lining will be of Oregon fir or lodgepole pine. This pine

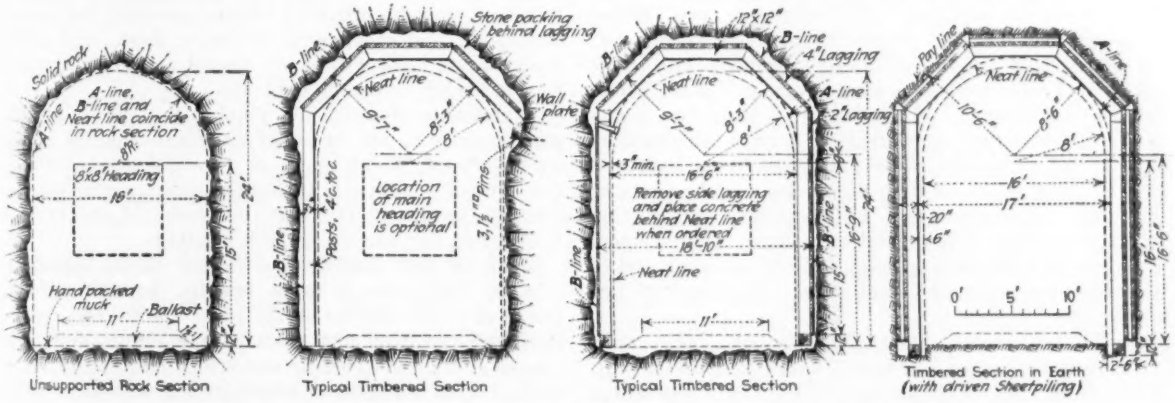


FIG. 2—RAILWAY TUNNEL THROUGH CONTINENTAL DIVIDE IN COLORADO

or other satisfactory timber will be used for the headings and for the pilot tunnel.

In the typical sections, Fig. 2, the *A* line is that beyond which no unexcavated material, timbering or support may extend, so that it is the line of minimum thickness of masonry lining or the neat line of excavation where no such lining is used. The *B* line is the limit of excavation to be paid for, and in some cases it is also the payment line for masonry.

Headings 8x8 ft. are planned, as shown, but the location of the heading in relation to the tunnel section is optional with the contractor. The estimated quantities of excavation are 10.83 and 14.95 cu.yd. per lineal foot for lines *A* and *B* respectively in the main tunnel, and 2.37 cu.yd. for the 8x8-ft. headings. It is provided that a planimeter may be used for measuring areas in estimating quantities where the computation of areas by geometric methods would be laborious.

Pilot Tunnel—A special feature of the work is the pilot tunnel or water tunnel, 8x8 ft., driven approximately 75 ft. south of and parallel to the main tunnel, as shown in Figs. 3 and 4. Cross-cuts of the same section will be driven at intervals of about 1,500 ft. and from these the main headings can be driven in both directions. This pilot tunnel will have the same profile and grades as the railway tunnel but will be at an elevation about 7 ft. above that of the latter. The excavation quantity is estimated at 2.4 and 3.3 cu.yd. per lineal foot on lines *A* and *B* respectively. Cordwood packing around the timber sets will be used in the pilot

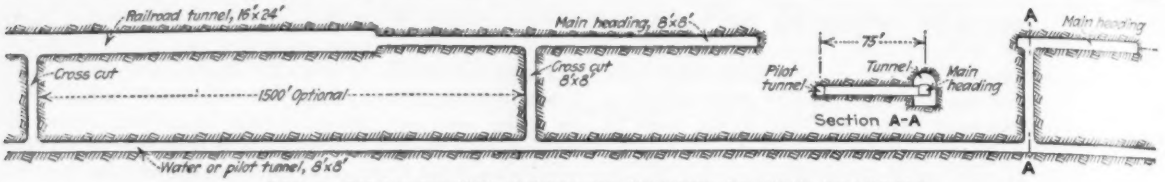


FIG. 3—PILOT TUNNEL INCREASES NUMBER OF MAIN HEADINGS

tunnel and also in the cross-cuts and main headings (see Fig. 4).

The pilot tunnel will serve for ventilation of the main headings and for the handling of materials and muck trains. After the completion of the work it is intended to use this smaller tunnel as a conduit for the supply of water to Denver, but the proposed connection with the Fraser River is not included in the present contract.

Rapid Tunneling—Rapid progress in tunneling is desired and the information given to bidders by the Tunnel Commission contained the paragraph noted below. The specifications also provide that in the purchase of equipment and supplies Colorado products are to be given the preference when quality and prices are equal.

"It is the purpose of the board to build the works in the shortest time consistent with good construction. To this end contractors will be required to use improved methods and appliances for doing the various parts of the work. Complete and well-designed construction plants and effective organization will be insisted upon. Attention is called to the magnitude of the work and to the need for machinery and other equipment of unusually large capacity."

Under the contract, the contractor is to begin work within ten days after a notice to this effect, and within thirty days from such notice he is to have assembled and installed sufficient plant for effective excavation at each portal. The entire work is to be completed within forty-six months from the first notice to begin operations.

Power and Light—The Moffat Tunnel Commission has contracted with the Colorado Power Co. for 1,000 hp. of 44,000-volt current, delivered at the east portal. A 30-mi. transmission line will be built, as noted in *Engineering News-Record*, July 12, 1923, p. 77. This contract will be assumed by the tunnel contractor, except as it relates to operation of the completed tunnel. The contractor will provide a telephone system connecting both ends of the tunnel and serving the local offices and the headings. Electric light is to be used, and in portions of the work where men and materials must pass the illumination must be equivalent to one 40-watt lamp for each 50 ft. of tunnel. Adequate special illumination must be provided where tunneling, timbering, concreting and other work is being done. All power machines or tools within the tunnel are to be operated by electricity or compressed air.

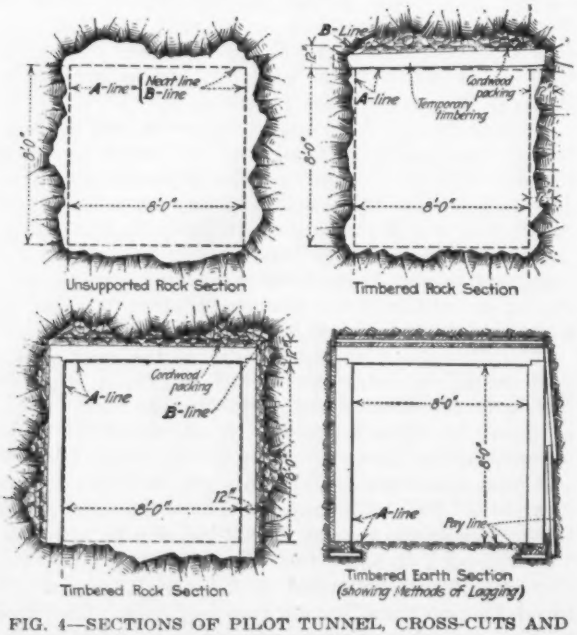


FIG. 4—SECTIONS OF PILOT TUNNEL, CROSS-CUTS AND MAIN HEADINGS

Ventilation—Ventilating plants, preferably on the plenum system, are to be of sufficient capacity to deliver at least 24,000 cu.ft. of free air per minute to the several headings. If high-pressure air is used to clear the headings after blasting, it should give at least 1,500 cu.ft. per minute in each heading.

Cleaning and Ballasting—Broken stone ballast of ¾-in. to 2½-in. size is to be laid by the contractor to the level of the bottom of the ties. Before this ballast is placed the floor and sides of the tunnel are to be cleared of dirt, loose stone and other material and then washed with a stream of water having a pressure of at least 30 lb.

Sanitary Requirements—Two camps are to be established by the contractor, and the specifications lay stress on enforcement of the sanitary regulations. Since the work is at an elevation of about 9,200 ft., where intense cold and heavy snow prevail during part of the year, pulmonary and other diseases are likely to become epidemic unless great care is taken. Sleeping quarters are to provide for each inmate 400 cu.ft. of air, 2½ sq.ft. of window area and 0.3 sq.ft. of ventilating opening which cannot be closed. The floor level is to be at least a foot above the ground. Houses are to be screened against mosquitoes and flies, and no stable or yard for animals is to be within 150 ft. of a dwelling house. The contractor is to supply blankets and pillows and to keep them clean. Each man is to have a bed or cot, and in single men's quarters not more than two men may occupy one room.

Near each portal and connected to the tunnel by a covered passage is to be a dry room where the tunnel men can change their clothes before and after work. This room is to be kept warm and fitted with shower baths and individual wash-basins. Lunches must be sent to men working so far in the tunnel that they cannot come to the mess room for meals. Hospital facilities are to be provided at each camp, in charge of medical and surgical practitioners, preferably those who have had experience in field and camp sanitation work under army or civilian conditions.

Water supply, drains, sewers and sewage disposal plants are to be provided. Garbage is to be removed promptly and placed in air-tight receptacles. All gar-

bage, refuse, manure, surgical bandages and general dust and rubbish must be disposed of every day by incineration or other approved methods. To facilitate the commencement of work the Tunnel Commission began the construction of sewer and water systems and housing facilities before the award of the contract for the tunnel.

Progress on the Moffat Tunnel—Up to Dec. 1 work had advanced so that the east heading of the 8 x 8-ft. pioneer or water tunnel was 370 ft. underground, in solid granite, while the west heading was 630 ft. in gneiss and pegmatite, which requires timbering. The full installation of compressors, locomotives and other equipment had not been completed at that date.

Engineers and Contractors—All administration and construction work on behalf of the Moffat Tunnel Improvement District is under the Moffat Tunnel Commission, of which W. P. Robinson is president, with offices at Denver, Colo. This commission has appointed a board of consulting engineers composed of D. W. Brunton, L. D. Blauvelt, J. Vipond Davies and J. Waldo Smith. The chief engineer of the commission is R. H. Keays; the resident engineers are V. A. Kauffman, at the west end, and B. G. Coy at the east end; Clifford A. Betts is office engineer. On Sept. 18, 1923, the contract was awarded to Hitchcock & Taylor, of New York and San Francisco. A period of forty-six months is allowed for the completion of the work.

California Court Denies State Can Cancel Road Contract

Highway Commission Cannot Rescind Contract In Order to Divert Funds Elsewhere, Is Supreme Court Decision

BY PAUL F. FRATESSA
Attorney for California Highway Commission

SHORTLY after the present California Highway Commission took office it was deemed good policy to rescind a contract then in effect which had been awarded by the previous commission. The reason for this was that the cost of the work which was being done on the unit-price plan was found greatly to exceed the engineer's estimate and the new commission preferred to stop the work and apply the funds to more urgent work in other parts of the state. The contract in question was held by George Pollock & Co. and covered the construction of a highway along the ocean shore in Monterey County.

The new highway commission accordingly made an agreement with the contractor whereby the contract was to be cancelled and the state was to pay the contractor a stipulated amount, based on the estimated value of the work done on the contract up to that time, and taking into consideration that the contractor had been to the expense of moving in his equipment, constructing camps, etc. The contractor thereupon presented a claim to the State Controller for payment of the amount agreed upon. The controller refused to allow the claim and proceedings were instituted in mandamus to compel its allowance.

In a decision handed down by the Supreme Court of California, Sept. 20, Judge Meyers held that the State Highway Commission has no power to enter into an agreement with a contractor whereby a contract would be cancelled and the contractor paid for his time and trouble. The decision in no wise affected the original contract, and the contractor is now proceeding to complete the work, this being the only apparent way in which he can collect for expenditures he has already made.

No Authority to Rescind Contract—The decision states: "By the execution of an authorized contract the state acquires certain legal rights and incurs certain liabilities which are fixed and ascertained, or ascertainable. Thereafter no one can either increase or diminish the rights of the state or increase or reduce its liabilities thereunder unless he has been vested with authority so to do by express grant or clear implication. The state having directed or authorized the making of the contract contemplates its performance and, as in the case of private individuals, the authority to breach such a contract is not to be implied from the mere grant of authority to execute the same.

"When, as here, the contract has been lawfully executed and has been performed in part, the amount which the contractor is entitled to receive for the work done is fixed by the terms of the contract. For the commission to pay him more than the contract calls for would, therefore, be to make to him a gift of public moneys, unless the commission has the power and authority to first breach the contract."

The court, continuing, recognized the fact that the law has vested in the highway commission a very great latitude of discretion and has given it "full possession and control" over all state highways and all expenditures for highway purposes, but held that the commission was limited in making contracts to follow the formalities specifically laid down by the law. That is, it can only enter into a contract for the doing of work and the expending of money, by advertising for bids or by following some other methods specially provided in the law.

The question as to whether the legislature might have passed an act authorizing the cancellation of this contract and reimbursing the contractor was not presented in this case.

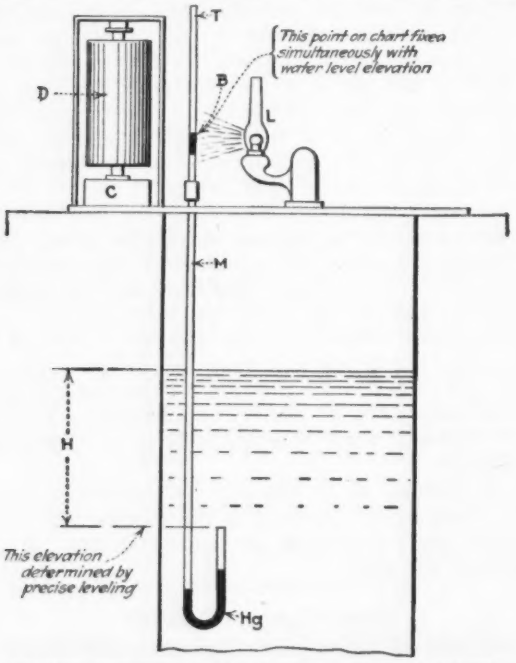
Some Figures on Taxes

The National Industrial Conference Board has issued a comprehensive study of the growth of public expenditures, taxation and tax exemptions of the federal, state and local governments. Some of the significant facts brought out in this careful survey are: Total taxes paid in the United States in 1922 aggregated $7,061,000,000. This amounted to 12.1 per cent or nearly one-eighth of the national income. It meant a cost of $64.63 to every man, woman and child. Each person had to contribute the income of 6¼ weeks to support the government in 1922, as compared with 3¼ weeks before the war. State and local taxes formed 58 per cent of the total taxes. The public payroll included nearly 3,400,000 persons. Every eleven workers, 16 years of age and over, supported one public employee. The cost of salaries of public employees aggregated $3,800,000,000, or $91 for every person ten years of age and over gainfully employed, or $35 for every man, woman and child. Direct and indirect taxes paid by farmers in 1922 were 16.6 per cent of their income. Those paid by the rest of the community were 11.9 per cent of their income. Real and personal property to the value of $54,000,000,000, or about one-fifth of the national wealth, was exempt from taxation in 1921.

Determining Hydraulic Gradient in Chicago Water Tunnels

TO DETERMINE accurately the flow of water in the Southwest Lake and Land Tunnel in Chicago and thus learn the maximum that might be removed from it at Seventy-third and State Sts., to supply the new pumping station on Western Ave., a new method of measuring and recording water elevations was devised. By this method the n in Kutter's formula was found to be 0.019 in the 14-ft. section, 0.017 in the 12-ft. section and 0.016 in a 9-ft. section, M. B. Reynolds, acting assistant city engineer, then engineer in charge of pumping station operation, describes in the 1922 annual report to the city engineer the methods used as follows:

In the planning of the work of locating the hydraulic gradient it was at first proposed to use observers at the various shafts along the entire line, but after some study



WATER SURVEY APPARATUS USED TO MEASURE WATER LEVELS IN TUNNELS

and discussion this method was abandoned for the reason that the gages could not be read accurately, because it was usually impossible to place an observer in such a position as to be able to read the water level. Also, the fluctuations in the water level occurred at such short time intervals as to make accurate observations an impossibility.

The second method proposed was the placing of some type of recording gage, such as the standard type of tide gage, or the more recent diaphragm or bell devices that are in use for this purpose, at the various shafts. Experience with recording instruments of the above type proved that they were unreliable, especially where comparatively small differences of elevations must be determined accurately. Their use was therefore abandoned.

Since all available methods or instruments were considered unsuitable for the purpose of determining piezometric heights, an instrument was devised that eliminates all lost motion and will accurately record extremely small differences of elevation. It consists of a manometer M made of ¼-in. iron pipe, a glass tube T of convenient length and a Pitometer Co.'s photo recorder, which consists of a lamp L and a drum D driven by a clock C. These recorders are in daily use in connection with water surveys of the division, and were therefore available. The manometers were made approximately 12 ft. long from the bottom of the U to the point of connection with the glass tube.

In use the U bend of the manometer is filled with mercury to about half the height of the short leg; the remainder of both short and long legs is then filled with water. The glass tube is attached and filled with water to a convenient height, depending upon the location of the recorder; and a kerosene bubble B dyed with aniline dye, about 2 in. in length, is placed on the top of the water level in the glass tube.

Due to the irregularities of both glass tube and manometer the instrument is calibrated by placing a long glass tube on the short leg of the manometer and varying the head of water in this glass tube. In this manner an accurate calibration of the movement of the bubble is made.

The instrument is placed in the shaft at such a depth that the short leg of the manometer is always submerged, the glass tube placed in the recorder, a sheet of sensitized paper placed on the drum, and the lamp lighted. From the sketch it can be seen that all variations in the submergence H will be transmitted to the bubble B and an accurate and continuous record of every piezometric height will be recorded.

Four of these instruments were used in making the survey. Precise levels were run from standard benches to the shafts, and accurate elevations of the manometers were determined. Attempts were made to pass correct elevations from the shore to the crib by reciprocal leveling, but due to atmospheric conditions elevations were not considered sufficiently accurate for use. The established elevation of the crib gage was used in locating the manometer elevation of the crib. These four instruments were operated simultaneously, giving the piezometric heights for every instant throughout the 24 hours. During the run tests were made each day to check the accuracy of the indicating bubble by measurement of submergence at each instrument.

The value of Q or flow during each day's run was taken from the station instruments and is probably not more than 2 per cent in error.

The values of n were surprisingly high and some doubt as to their accuracy arose, but subsequent checks proved that the values originally determined were correct.

Half-Year Ocean Passenger Traffic 450,000

The Bureau of Research of the United States Shipping Board in its report on passenger traffic to and from the United States, classified under three heads: overseas, nearby (including Canadian and Caribbean) and non-contiguous United States territory, shows the following: New York leads all American ports in the overseas movement with a total of 208,359 passengers handled in the first six months of 1923. Second for the United States and first on the Pacific Coast comes San Francisco with 19,170, followed by Boston with 11,369 and Seattle with 6,046. The total movement of passengers for the six months in the overseas trade was 249,002, of which 152,436 entered and 96,566 departed. Third-class traffic made up more than one-half of the incoming passenger business, but less than one-third of outbound. Of passenger traffic with the nearby countries, chiefly first-class traffic, there was a total movement of 197,750 first-class passengers, while the entire overseas first-class movement of all coasts was but 56,396. Of the foreign districts the movement between the United States and the United Kingdom amounted to 64,210 passengers. Germany and the Scandinavian nations showed 78,737, while Holland, Belgium, France, and Spain were responsible for 41,770. The Oriental traffic, to China, Japan and the Philippines, totaled 22,679. South American ports handled but 7,939 passengers, of whom 6,265 sailed from or to ports on the east coast of South America and 1,674 from or to ports on the west coast of South America.

What Car Owners Should Pay for Road Building

Formula Proposed for Figuring Vehicle Imposts—Gas Tax Best Measure of Road Use—Five-Cent Tax Generally and Ten-Cent Tax in Some States Proposed

By A. R. Hirst
State Highway Engineer of Wisconsin,
Madison, Wis.

A paper presented before the Annual Meeting of the Michigan Good Roads Association, Lansing, Mich., Nov. 6, 1923.

THE MOTOR vehicle owners of each state should each year pay for their highway service one-half of the total amount made available in that year to pay the cost of the state's highway program, after deducting from said amount the total amount made available to pay the cost of the state's highway program in the year 1904.

The year 1904 is selected as the basing year because quite dependable figures of highway expenditures in all states are available for that year, and because it quite accurately marks the real beginning of the motor era.

Please read the formula again before condemning it and note especially that its terms do not include the expenditures made in any year from the proceeds of bond issues, but only the portion of the cost of bonding paid in that year.

Applying this formula to a hypothetical case: In a certain state there was made available in 1904 to pay the cost of all highway work, $10,000,000. There is to be made available $40,000,000 in 1925. The amount the motor vehicle owners should pay in 1925 is one-half the difference, or $15,000,000.

The formula means that there would be paid by property and from other sources of governmental incomes:

(a) The total cost of highways which they paid at the end of the era of horse-drawn transportation.

(b) One-half of the additional highway cost imposed upon government by the ownership and use of motor vehicles by individuals.

It of course means that the owners of motor vehicles would pay:

(a) One-half of the additional highway cost imposed upon government by his ownership of motor vehicles.

Translated into national figures the formula means that based on total highway expenditures of $200,000,000 in 1914 and of $1,000,000,000 in 1923, the motorist should have paid $400,000,000 in 1923 for use on highways; this does not include the luxury tax and the personal property tax, neither of which is a tax for highways. Compared with the actual payment of $200,000,000, this means that motorists should have paid $200,000,000 more than they did pay in 1923, or approximately $14 more per motor vehicle, on the average.

We expect that many will oppose any proposed application of the formula to specific tax problems. We do not claim that it is perfect. In meeting especial conditions in certain states its arithmetical result would have to be modified by the application of common sense. We do claim, however, that it is of value as a guide to judgment. We do claim that it is the first mathematical formula proposed that recognizes the existence of the fundamental facts which should largely determine the relative part of the cost of highway programs to be paid by motor vehicle owners as such, and by other taxpayers as such.

Let us briefly summarize and comment upon the various common forms of taxation upon motor vehicles.

Valuation Taxes—We believe that there should be a valuation tax upon motor vehicles if there is to be a valuation tax upon any class of property. Of course, if the theory of collecting taxes upon the basis of the valuation of property is wrong, then a valuation tax upon motor vehicles is wrong. Vice versa, if the valuation theory generally held is right, then the collection of a tax based upon the relative valuation of motor vehicles is right.

The more expensive automobiles are owned for the same reason that the more expensive homes are owned: that is, because the owner believes that they repay him for the added investment and the added running expense in style, comfort, economy and convenience, or in the ability of himself and his family to enjoy life. If he really believes these things are true, he should be willing to pay an additional price to own and operate the more expensive house or motor vehicle. It should be recognized, however, that a valuation tax on motor vehicles is not a highway tax but a property tax.

Horsepower Taxes—Many states license motor vehicles upon the basis of horsepower. We can think of no physical attribute of a motor vehicle which bears so little relation to its destructiveness as does its horsepower. Horsepower bears little or no relation to the speed, the weight, the value or the use of a motor vehicle. There are at least thirty-two passenger car models on the American market which have the same or less horsepower than the Ford. These thirty-two models weigh from 1,600 lb. to 3,500 lb. and retail at from $500 to $2,500.

Licensing by Weight—This system somewhat classifies the relative destructiveness of various cars as between themselves, and of motor trucks as between themselves and as distinguished from automobiles. Weight has also some relation to value, but only when the vehicles are new. If there is to be a graduated classification of cars for the purpose of licensing them, their weight is the best factor. We believe there should be such a classification.

Motorization and Highways

In 1904 there were in operation in America about 58,000 automobiles. There were practically no motor trucks. In 1914 there were registered 1,711,339 automobiles and motor trucks. In 1919 there were registered 7,530,105 automobiles and motor trucks. In 1923, preliminary figures indicate a total registration of at least 14,000,000 automobiles and motor trucks.

In 1904 the rural highway expenditures of America are reliably computed to have been $59,527,000; in 1914, $240,264,000; in 1919, $389,466,000; and in 1923 they are estimated to be at least $800,000,000. Roughly, the rural highway expenditures per motor vehicle in operation in 1904 were about $1,026; in in 1914, $140; in 1919, $52; and in 1923, $57. The expenditures per motor vehicle in 1923 were 5 per cent of those of 1904; 40 per cent of those of 1914; and 110 per cent of those of 1919.

If we could, through the development of a real system of highways, reduce the operation cost of motor vehicles 1c. per mile (and we can) the annual saving to motorists would be $560,000,000. This capitalized at 4½ per cent would represent an investment of about $12,500,000,000. This could be proved to be a profitable outlay on this one item of saving alone.

We must brush our brains clear of cobwebs, obsessions, prejudices and bunkum, and calmly recognize that when we bought and insist upon operating fourteen million or more motor vehicles, we bought also a highway expenditure of billions of dollars, just as much a part of the cost of these motor vehicles as are themselves, their tires, their engines, and their supplies. They go together, the motor vehicle and the highway on which it must run. All the costs must be paid.

A. R. Hirst.

"Police Power" Licensing—This is a necessity. The cost of the license plates, licensing and of proper motor vehicle policing should be included in the weight license fee and collected at the same time.

Franchise Taxes, Wheel Taxes, etc.—Some states still permit units of government smaller than the state to make charges upon motor vehicles in addition to taxing them as personal property. We believe that such charges should not be allowed to be made but that the full charge for the use of highways should be imposed and collected by the state. Outside of the debatable federal luxury tax now in effect, we believe that the federal government should not tax motor vehicles.

The amount which the motor vehicle owners should pay for highway service is a thing individual to each state. It should be determined upon by the legislature of the state as a result of the most mature deliberation. Simultaneous increases made by several units of government might, if permitted by law, seriously embarrass the motor vehicle owners and the motor vehicle industry.

The states are the best and should be the only collectors of imposts for highway service made upon motorists. If the division of responsibility for the main highways is such as to make it advisable, there should be distributed to the counties a part of the proceeds. The state and county highway programs in every state should and will consume all that the motorist should fairly pay toward the highway program. The lesser units of government, such as townships, cities, and villages, should be content to see the state and county taxes on property for highways reduced by larger collections from motor vehicles. This will enable them to increase their charges upon property for strictly local purposes, including local highways.

The sum which can fairly be collected from motor vehicle owners has a maximum. If the federal government takes a share and the local municipalities take a share, the state and county share will be so much the less. Necessarily the state and counties must make up the deficit by imposing direct taxes upon property or by taking a larger share of income taxation. This simply complicates the situation without changing the final result as to the total taxes paid by the various classes of property.

Motor Fuel Taxes—The motor fuel tax, commonly known as the gas tax, in our opinion is by far the most scientific impost upon motor vehicles. It meters highway service and the benefits received from the use of highways. It approximates toll gate results without the infirmities of toll gate procedure. The consumption of gasoline varies with the weight, the speed, and the mileage of the motor vehicle. No other factor in the car's domestic economy reflects so closely the benefits received from highway use.

It has been suggested that a tire tax would be just as good as a fuel tax. This might be true if it were not so easy to mail or ship tires, but we fear that if a tire tax were in effect the business of every tire dealer would be with people of other states. This would yield no revenue to anyone. On the other hand, gasoline is bought usually from day to day, is best bought in that way, and can thus be handled more cheaply and more safely than if shipped and stored for individual use.

Objection is made that the worse the road, the more fuel consumed, and the more tax paid. This objection cannot be met by any argument which we can devise except that as highway construction proceeds, the mileage of road that this objection applies to will become less and less. It is the only practical objection ever urged against the fuel tax, and objections equally valid can be urged against any tax ever in effect or ever proposed.

States can adjust ad infinitum license fees fixed by the horsepower, weight or valuation of motor vehicles, or by any combination of these factors. They can probably attain some fairness in the relative fees to be paid by the different kinds of cars and trucks. It can be determined that a Ford should pay so much, a Cadillac so much, a five-ton truck so much. The relation thus established between them may be fair. But how about the relation between the Ford which travels 2,000 miles and the Ford which travels 15,000 miles—the Cadillac which travels 5,000 miles and the Cadillac which travels 40,000 miles—the five-ton truck which travels 5,000 miles, and the one which travels 25,000 miles?

If the relative use of railways by various motor vehicles is to be included as a factor in determining the highway tax to be paid by the motorist, then the motor fuel tax must be in effect as one factor in the total imposts. It is the only practical way to collect impost which marks relative highway use and the relative benefits therefrom.

We believe that many states will find it necessary, at least during the coming heavy construction period, to impose fuel taxes of about five cents per gallon. States which have been extremely backward in highway development may have to collect as high as ten cents a gallon. We believe it will be usual to exempt fuel used other than in highway transport from paying the tax. This will cause some abuses, but there are abuses in every tax system. As soon as motor fuel taxes of quite uniform amount are in effect in every state, practically every objection to the gas tax will have been eliminated, and a method of highway taxation and of highway financing will have become universal which is as nearly in accord with the equities in the case as human ingenuity can devise.

How Chicago's Asphalt Pavements Were Examined

Methods Used in Critical Study—Trucks Carrying Cutter "Gun" Replaced Hand Cutting—More Rigorous Inspection Recommended

By Paul E. Green
Consulting Engineer, Chicago

BECAUSE of widespread newspaper accusations of faulty work the finance committee of the city council of Chicago determined in the spring of 1923 to investigate pavements laid in 1922. The writer was employed to do this work and a fund of $40,000 was provided. Nearly 1,000,000 sq.yd. of 1922 asphalt construction was sampled and laboratory tests were made of the samples. The methods employed in the examination had to be developed and present some points of novelty.

The investigation showed that in general the full amount of material specified was furnished and that there was too great a variation in workmanship and probably some carelessness both in workmanship and inspection. A variation of 33 to 50 per cent was not uncommon in the thickness of the surface and in some cases the variation was 100 per cent. Where such variation was found it was noticed that the surface was not smoothly and evenly rolled. Much of this variation in the top was due to an excess or deficiency in the thickness of the foundation, though it was rare that the thickness of the pavement, both base and wearing surface, collectively and individually was not close to the specificafion requirements.

The first equipment furnished by the city for the work consisted of a gang of four laborers and a foreman, with hand cutting tools, a team, driver and portable asphalt repair wagon. Samples 12 in. square were taken for approximately each 2,000 sq.yd. of pavement, and for each three samples of surface a test hole was made through the foundation. Observations were made as to the surface of the pavement, the curb, the grading, the drainage and all other items which enter into the construction of this type of engineering work. All measurements as to thickness were made with calipers.

It was soon demonstrated that the taking of complete samples by hand was a very slow process and uneconomical. Nor could the necessary repairs (which were made immediately after the sample was taken) be made to advantage. Too much lost time resulted and not rapid enough progress was made. About the best that could be done per day was fifteen cuts, of which five included the concrete foundation. The average was less. In addition, as the work was started in early spring, the asphalt top was so hard, frequently containing frost, that the cuts chipped badly and in order to get a good sample it was necessary to make a large opening. This meant more material for repairs, more labor in handling the samples to the laboratory and exhausted laborers. Since the cuts were so large, the repair could only be called a temporary one and would later in the season have to be replaced by a permanent patch as part of the regular maintenance program. As all such work was presumably to be charged against the fund provided for the examination it soon became evident that a more efficient method was essential.

Use Cutter "Guns"—The bureau of streets as a part of its regular equipment has several trucks equipped with compressors which operate automatic cutter "guns." Each truck has four guns which work like a riveter. One of these trucks was secured. This outfit immediately expedited the work about 50 per cent and in addition enabled the gang to secure small uniform samples. The principal trouble then was that the repair part of the gang (equipped with a horse-drawn repair tank) could not keep up. Much time was lost in transporting the material for the mix, and in moving from day to day the "camp" or tool box of the gang. It should be kept in mind that the examination included many contracts scattered widely over 200 square miles of territory and that under the best of circumstances much time was lost in moving from job to job. Up to this point all repairs had been made by hand mixing of "black base," or in effect binder, for the foundation cuts, and a crude top mixture for the surface.

Three permanent asphalt plants of large capacity, owned by the city, are located at strategic points to cover the entire city. Only two were operating at the time of the examination. In a territory of this area (200 square miles) with approximately 3,000 miles of paved streets, the location of the plants meant that the haul from the plants to the point of examination might be 10 or 12 miles, an impossible distance with horse-drawn apparatus, but perfectly practicable for a truck. In order then to expedite the tests, it was determined to try the experiment of loading a regular asphalt construction truck with hot top mixture at the plant about 9 a.m., keep it well covered, and hope it would stay hot until the last repair was made about 3:30 p.m. The labor gang, reduced to two men to operate the cutter, would start at 8 a.m. on the street, proceed steadily ahead and the other two men with the asphalt truck would follow, starting about 1½ hours later and catching up by the end of the day. This scheme worked well. The number of cuts made increased to an average of twenty-two instead of twelve per day. The repairs were made in permanent shape and the hard manual labor reduced materially. The "hot stuff" stayed hot, the only difficulty being that on account of the small amount actually used in making the repairs there was considerable excess to dispose of each day and this was not always an easy matter. That part of the problem was solved by putting the mixture in a barrel at the plant instead of taking a load, thus reducing the quantity, but keeping it at a better temperature and eliminating waste.

Base Sampling—Cutting the foundation so as to obtain a laboratory sample suitable for crushing presented many difficulties. It had been determined that the best method of investigation would be to secure small cubes of the concrete, crush them, and from new aggregate to prepare a similar laboratory specimen for crushing after 28 days. This prepared sample would furnish a measure for the field sample, and while it was not the thought to compare field and laboratory samples directly, it was considered that properly plotted curves could be made which would show very clearly the variation in the character of the work. A quantitative analysis to recover the cement was not deemed practical.

Cutting was done with an automatic bull-point drill. It was felt that a large 4-in. core drill would best do the cutting but none could be secured in time for the work. This part of the investigation therefore was not complete and observations could only be secured along general lines.

Much new information was obtained. One of the most important facts observed was that the subgrade was nearly always damp though all the streets were sewered. The foundation was often damp right through to the binder, indicating porous concrete and probably lack of careful mixing. Such a condition of moisture may account for some failures of the wearing surface.

Conclusions—The conclusions reached for Chicago conditions were as follows:

1. Extensive studies should be made of subgrade moisture of our city pavements, even when apparently adequately sewered.

2. The fine grading of the subgrade should be done to a templet to get the best results.

3. The same provision should apply to the concrete foundation.

4. The top surface would be much more uniform and smooth if the recommendations under 2 and 3 were carefully observed, and thus tractive effort reduced and the life of the surface increased.

5. Extreme care must be taken to seal the surface at the gutter, and at manhole openings to prevent the ingress of water. The junction of the concrete gutter used in Chicago, with the asphalt surface should be redesigned to make a more positive seal.

6. A city having a large yardage of asphalt should be provided with a core-drill testing machine and no work accepted until it had been tested by such a machine. The samples should be kept as part of the record.

7. The quality of the work would be improved if samples of the foundation for crushing tests were made at the time of construction. These samples should then be compared with core-drill samples taken under 6.

8. There is danger in large cities of the work and specifications becoming too standardized and inspection too routine. The inspector on the job must be carefully trained and kept "on his toes." At least two daily visits from a supervisor are necessary. Inspectors should be placed with the grading gang and the sewer connection gang and that division of the improvement scrutinized with the greatest care.

Through the Reclamation Country

By F. E. Schmitt
Associate Editor, *Engineering News-Record*

THIS is the eleventh of the series of letters written by Mr. Schmitt during a journey recently made through the West in which he visited irrigation projects, studied developments, and interviewed builders, operators and settlers, in order to present to our readers the actualities of reclamation as revealed to an unprejudiced investigator.

The series of letters began in the issue of October 4.

La Junta, Colo.

A CHEERFUL pessimist remarked a few weeks ago that irrigation finance is a skin game, which in past years cleaned out one or more crops of trustful investors, and since then has been waiting for a new crop to grow up. He also intimated that this new crop seems to be about ripe. Right or wrong, his remark ties up curiously with a number of conditions and developments in the arid West, all bearing on the future of irrigation, private as well as federal.

Future Private Irrigation—The era of public land reclamation as contemplated in the 1902 act of Congress seems to be about over; irrigable public land in bulk is gone. The amount of fertile land in the West far exceeds the available water, but virtually all remaining land is privately owned. This seems to mean private irrigation enterprise, or else a new reclamation policy. The future work will be at a disadvantage, however. While less than half the available water has been used, the rest will be very costly to impound and spread over the land. All the reasonably favorable irrigation projects have been exploited. Land promoters have combed them over, and the federal people have done the same, in some cases even more anxiously, since the law obligated them to find a project in every western state whether or no. In consequence we are now right up against high-cost projects, developments whose per-acre cost goes far beyond even those costs of existing projects which have been declared by the farmers to be impossible of payment.

At present, we are told, those reclamation projects which cost more than a certain sum per acre (say $75; people differ on the figure) cannot in general pay a higher construction installment than 4 per cent; the farmers balk at the 6 per cent installment which under the twenty-year repayment law must be made in all years after the sixth. Since the farmers do not have to pay interest to the government, it follows that private enterprise could never get even its interest. Yet there is a considerable activity in irrigation promotion in the West just now.

The investing public is hard-boiled, of course. It needs to be convinced that irrigation securities are good. Having been taken in on irrigation bonds in past decades, and more recently in other doubtful investments, it now desires to be shown. Means have therefore been provided to show it.

State Endorsement—Most or all of the western states have passed laws providing for state approval of irrigation plans. When a project is approved it is "certified" by the state. This is supposed to reassure the investor. It may reassure him, but whether it gives any real assurance that his money is soundly invested is open to question.

More than thirty years of irrigation enterprise have shown by the loss of many millions of investment that a good design for an irrigation system will not automatically pay interest. Neither will well-built works. Settlers must come and use the works; they must be good farmers and must build up a profitable farming business; and they must keep this business in permanently sound shape, fighting off seepage, blight, and grasshoppers. Unless such a successful farming community is built up, the mere irrigation works are dead property, even if the state built them. It may take many years to build up such a community, and the project meanwhile may fail; yet, blandly disregarding this risk, the states now attempt to say, in effect, that the investor may safely put in his money, on the strength of state examination of the mere plan.

Some states have made the reassurance stronger. Oregon has recently passed a law which permits the state to guarantee the interest on irrigation district bonds for part or all of the first five years, and under this law the state now pays such interest. To the intending investor it will surely seem good to buy bonds whose interest is guaranteed by the state. However, after the first five years he will have to look out for himself. An Oregon land banker expressed decided doubt whether all the new districts would be on a profitable footing after five years—in other words, whether their bonds would be good after that time. Meanwhile the bond broker has further jeopardized the success of the project by pocketing 15 per cent of the bond proceeds. *Caveat emptor!*

Still another step has been taken by Oregon's northern neighbor. Washington has a new law which sets aside a certain amount of money each year for state purchase of the bonds of irrigation districts. This makes the securities still more attractive: they are so good that even the state invests its money in them! But just how such state investment will make the successful agricultural development of a project more certain is not obvious.

Another curious side to the matter of private irrigation development enters the case. Land may be made less valuable by the construction of irrigation works than it was previously, at least as concerns loan values, which in some way are a measure of actual values. This sounds paradoxical, but it is the statement of a land banker, and is explained in this way: Suppose a piece of unirrigated land suitable for at least some use is worth $20 an acre, and on the 50 per cent basis has a loan value of $10 an acre. If irrigation works are constructed at a cost of $80 an acre, which cost is a lien on the land, then the equity or loan margin is still $20 per acre, and again on the 50 per cent rule a loan of $10 might be made. But this loan would be quite unlikely to be made, as the banker would consider the $80 lien so heavy an incumbrance as to make it unsound practice to risk a further loan, the more so as this would be a secondary loan. In other words, the man who could get a $10 loan on the unirrigated land could not get any loan on the irrigated land. The irrigation improvement thus has resulted in a temporary reduction of value, a loss which is restored only when the land is in successful agricultural production. The condition noted, of course, tends to increase the already serious financial problem of irrigation.

State Irrigation—But, to take a more optimistic view, there is a strong hopeful element in the situation. If the state certification and guarantee laws mean anything, they mean that the western states have begun to recognize the fact that there is a state responsibility in irrigation development. For the present this recognition is painfully weak, but in time it may grow to the point where the state realizes that the whole irrigation problem is its own problem, and proceeds to undertake settlement and agricultural development and the financing of the new settler through his starting-up period.

Up to the present we have continued to think of irrigation development as a proper field for private enterprise, just like starting up hat factories or iron foundries. Some of the wisest people in the West seriously doubt whether it is a private function at all. A senator of broad outlook made the penetrating comment on the whole subject of irrigation, "There is no room for a middleman between the farmer and the water." In other words, as hundreds of cases have shown, a corporation that undertakes to supply irrigation water to the farmer and make a profit out of the transaction is very likely to meet disappointment, incidentally getting the farmer into trouble also, in many cases.

Irrigation districts are thriving by virtue of this truth. They represent direct water service, without profit, and they also are a device for bringing the problems of the water user and of the water distributor into direct co-ordination. However, development of vacant land can not well be done by the district method, and this field needs to have some other method devised. Just at present it seems as though the state must supply that method. This statement, however doubtful it might otherwise be, has the solid backing of the success made by California in its development work at the Durham and Delhi settlements. The state showed there that the problem of settling up an irrigated tract with capable settlers, and giving them so effective a financial start that the early operating loss is reduced to very small proportions, can be handled by the state in a way that neither private enterprise nor federal organization could match.

More Reclamation?—There are those who say that federal reclamation ought to be continued as actively as during the past twenty years, and there are those who say that agriculture is heavily over-developed. The latter seem to be in the majority. One authority states that California's irrigated land is 40 per cent vacant, and these conditions are not peculiar to California. Low prices for agricultural products tell of over-production, a supply exceeding the consumption, so that under present conditions, where an elastic market is lacking, the farmer loses in the bad years because he has nothing to sell and in the good years because he must sell below cost. Such conditions do not represent a natural demand for development of more farms at high cost. Above all, they do not afford a very good argument in favor of the wholesale development of farming regions ranging from 100,000 to 1,000,000 or more acres, such as various promoters have been proposing.

Very likely, federal reclamation in its beginning was the answer to an urgent need for making western arid lands fruitful on a basis of sound planning and a square deal. Today there does not appear to be so urgent a need for the nation's intervening in these problems of local development. However, precisely this is the central point of the reclamation policy that Congress is bound to lay down for the future.

Justifiable Cost—If Congress will have to say under what conditions there is an economic justification for the nation to reclaim more western land, it is also partly up to Congress to say how the justifiable cost of irrigation development is to be fixed. At the moment the situation seems to be deadlocked. Reclamation has been carried on with increasing cost of development to the point where the reclamation farmer says he can't pay even the interest on the cost. In fact, this claim is made even on projects where the costs are well below the maximum. How, then, can still more costly reclamation projects be warranted? This question finds no answer. Or, rather, there are three answers, which do not agree at all.

One answer is that by proper methods the conditions can be made favorable for high production, and the operating loss of the early years avoided, just as at Delhi the state of California makes the farmers' business pay even though the land and water alone, without farm development, cost over $200 an acre. Of course, this implies much control, to get good farmers, well developed farms, and efficient farming systems. Men who do not favor such control but prefer the normal go-as-you-please type of development, have a different answer: that the demand for farm products is bound to increase steadily, until in a few years the demand will exceed the supply and agricultural incomes will rise to the point where they can pay even the largest development costs yet contemplated. The third answer is that it does not matter whether the land can pay for the irrigation works; making arid land fit for settling and home development is so inestimable a public benefit that the nation (I have never heard the argument applied to the state) can afford to invest almost any sum in irrigation, even without hope of return.

Whether the national-benefit plea has any force or not, certainly so far as private irrigation development and local development are concerned the question of justifiable cost of development must be answered in convincing figures. The land promoter or the district cannot afford to go ahead without at least a fair chance of getting the money back out of the soil. Perhaps the land promoter does not care so much whether the soil will pay, so long as he can make the prospects look rosy enough to intending buyers so that all his land will sell. But a district, or a state which morally or financially underwrites irrigation securities, must figure more carefully.

So far as the facts give a clue to the answer, they are that much promotion of irrigation development is now in progress which bases on unit costs of $100 and more, though no such developments have yet gone through the financial test; and, on the other hand, that the federal reclamation projects, with lower costs, are claimed to be incapable of paying out. Probably the West will have to take the lead in reconciling these conflicting facts. Congress cannot be expected to do so by decree. But it seems clear that Congress will have to lay down some guiding principle by which any further federal reclamation that may be undertaken can be selected and planned consistently. If this principle is clearly enough stated, it ought to be of great

help in making the basis of private irrigation investment more sound than it seems to be at present.

Many Irrigation schemes—Just why the West should be full of new irrigation schemes under present conditions, when agriculture is not on a paying basis, is not clear. Possibly the general boom spirit of the West, its desire to develop, is the motive impulse. The fact is there are very many schemes for new irrigation, and most of them seem to revolve around the expectation of getting money from the federal government. This makes them of direct interest to all parts of the country at the present juncture.

Some of the schemes concern new developments of ambitious character. Most notable of these, of course, is the Columbia Basin project in Washington, where it is proposed to irrigate 1¾ million acres at $200 an acre (the figure is somewhat in dispute). Nearly as ambitious is a Utah scheme which aims at development of the full possibilities of the Great Salt Lake basin. And there are plenty of others.

Invariably the federal pocketbook is expected to furnish the funds. It is not easy to tell whether this is because the state cannot raise the money, or because the state is unwilling to risk its money and take the chance of loss. If the undertakings can be shown to be profitable, the state ought not be financially timid; and if they cannot be shown to be profitable, is the investment any more attractive for the nation than for the state?

Besides these new schemes, there are many existing irrigation projects that have gotten into difficulties and want government help—"lame-duck projects." A few of these have already been forced on the Reclamation Service and others seem to be going the same way. As a result, there is a chance that reclamation will not be able to make as good a financial showing five years from now as at present. And there are still other cases, such as getting the government to build irrigation works for a Nebraska district that already has plenty of water. In short, the desire to get federal money to put into western irrigation continues to be as strong as it ever was; if anything, it is getting stronger. And as matters stand there seems to be no established principle, whether in the reclamation law or in the western mind, as to how and when an irrigation investment by the government is worth while. Some people seem to think that any federal money that can be obtained for any irrigation scheme is good money.

It would obviously be of the greatest help under these circumstances to have a sound workable basic principle laid down by Congress to guide future reclamation investment—for example, the principle that every project undertaken must be able to pay its keep.

But even before such a principle is established the question ought to be considered to what extent land irrigation is a federal function. The complicating factors of interstate and international water rights affect some cases but not all. Conditions that twenty years ago made the western states unable to do reclamation work of their own are probably no longer present. Reclamation as it exists today seems to be a kind of business, like running railroads or ship lines. It seems to be accepted doctrine that the federal government ought to keep out of business as far as possible. Ought it keep out of reclamation?

Water-Curtain Fire Protection of Union Central Building

A WATER-CURTAIN system for protection against outside fires has been installed on the tall office building of the Union Central Life Insurance Co., Cincinnati. It represents a direct result of the disastrous Burlington Bldg. fire in Chicago, March 15, 1922, when a modern sixteen-story office building of so-called fireproof construction was completely gutted by fire entering from burning buildings on the other side of the street. Pumping tests made of the Union Central Bldg. installation during a two-hour period on Nov. 18 showed it to act very effectively in covering the exposed sides of the building with a flowing sheet of water protecting it further by a curtain of finely divided falling water or mist. A picture taken of the water curtain in operation on the south and east sides of the building is reproduced as Fig. 1 herewith.

Two sides of the Union Central Bldg. front on streets. The west side directly adjoins a seven-story building, while the south side is separated from adjoining buildings by an alleyway (Baker St.). Protection was considered necessary primarily on the west and south sides, but the two rows of windows next the north and east sides were also protected. The installation comprises an open sprinkler or nozzle in the middle of the head of each window, facing down and inward toward the window; the sprinkler openings in the upper part of the height are ⅜ in., those in the middle part, 7/16 in., and the lower ones, ½ in. Occasional windows or tiers of windows are omitted. As indicated on the diagrammatic perspective, Fig. 2 herewith, the system extends from the 17th floor to the 3d on the south side of the building, and to the 9th (roof level of adjoining building) on the west side. The two

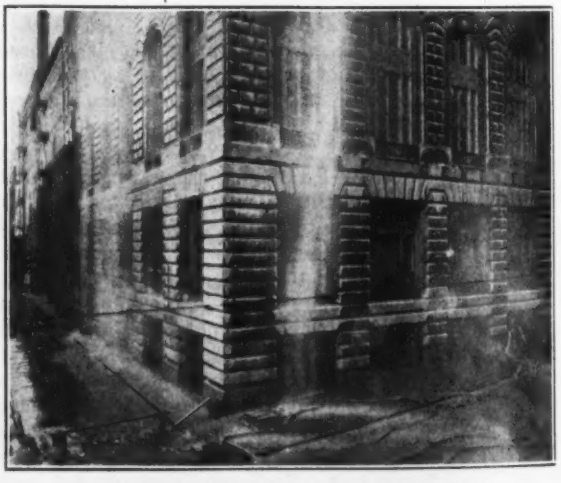


FIG. 1—WATER-CURTAIN IN OPERATION

South side of building (left) fully equipped; east side of building (right) equipped on southerly two rows of windows.

adjoining rows of windows on the east and north sides are protected from the 17th floor down. The total number of sprinklers is 291, there being 148 on the west side, 93 on the south side, 30 on the east side, and 20 on the north side.

Normally the system is dry. Water enters the

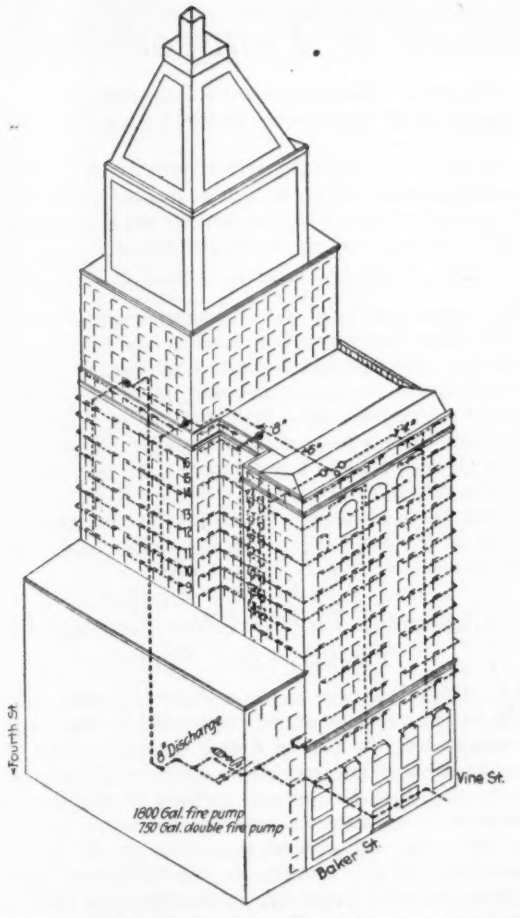


FIG. 2—WATER-CURTAIN EQUIPMENT ON WEST AND SOUTH SIDES OF UNION CENTRAL BUILDING, CINCINNATI

No protection was considered necessary on the north side of the building, which faces Fourth St., and the east side, facing Vine St., except on the two rows of windows adjoining the exposed west and south sides. The south side of the building (right front in diagram) faces a narrow street or alley and is fully protected by water-curtain.

sprinkler pipe system only when the sprinkler pumps in the basement of the building are started. These are a steam pump capable of providing 750 gal. per minute and an electric pump of 1,800 gal. capacity, both working against 150-lb. pressure. The steam pump is the fire pump of the building, and the sprinkler connection is additional to the building standpipe connection. The electric pump serves the sprinkler system alone, and being located 12 ft. above boiler-room level it can be kept in operation even when the boiler room is flooded; however, this electric pump also has a suction connection for draining the boiler room when water enters the latter. Besides the pump supply, the sprinkler system can be supplied by fire department pumpers from two 6-in. steamer connections outside, equipped for eight 2½-in. hose connections. Street connections as well as pumps discharge into an 8-in. riser pipe extending up to the pipe gallery floor (between the 16th and 17th floors), where the water is taken by a header distributing to six 4-in. vertical feed pipes on the outside of the building, supplying the sprinkler branches direct.

The outside piping (5,000 lin.ft.) is extra heavy galvanized wrought iron, with galvanized fittings and hangers; it is held by anchors set into the brick backing of the exterior terra cotta. It weighs 14,000 lb.

In the test the sprinkler system was supplied from the steamer connections. A full supply was obtained at the 17th floor, the highest sprinkler line, 250 ft. above street level.

Separate from the sprinkler system the Union Central Bldg. has three 6-in. risers for fire outlets with a 2½-in. outlet and hose on each floor. These pipes are supplied from a 3,000-gal. tank on the 30th floor (base of tower) and a 5,000-gal. tank on the 18th floor, and also have Siamese street connections. Standpipe and sprinkler systems are independent.

The decision to install this water-curtain equipment was due to the desire of the owners of the Union Central Bldg. to protect themselves against such an occurrence as the Burlington Bldg. fire. The insurance company occupies the 3d, 11th to 17th and part of the 18th floor, the latter housing the company's records. Investigation by Capt. M. W. McIntyre, manager of the building, indicated that wire glass supplemented by a sprinkler system would give the best exposure protection known. Wire glass will stand up until it melts at 1,500 to 1,700 deg. F.; but enough heat would probably be radiated through the glass to ignite combustible material inside the building. This led to the decision to adopt sprinklers for keeping down the temperature of the sides of the building where exposed to a fire and intercepting radiant heat. The installation was planned and carried out by the Grinnell Co., Inc., with check and supervision by the Underwriters' Laboratories. Assistance was given in developing the system by J. A. Hiller, superintendent of water, and B. J. Houston, chief of Fire Department, Cincinnati, and Capt. J. J. Conway, superintendent of the Underwriters' Salvage Corps in that city.

Automobile Accident Deaths Increase

The Department of Commerce has announced that according to the returns of the Bureau of Census there were 11,666 deaths caused by automobiles and other motor vehicles (excluding motorcycles) in the United States in 1922. This represents a death rate of 12.5 per 100,000 population for 1922 as against 11.5 in 1921, 10.4 in 1920, 9.4 in 1919, 9.3 in 1918 and 9.0 in 1917. The following list of cities of a population of 300,000 or over is arranged according to the 1922 rate:

DEATHS BY AUTOMOBILE PER 100,000 POPULATION

Cities	1922	1921	1920	1919	1918	1917
Los Angeles	29.5	27.1	24.1	21.1	16.8	19.8
San Francisco	22.3	18.1	17.2	16.9	15.0	14.9
Chicago	22.0	20.5	17.3	12.3	11.7	12.1
Pittsburgh	20.2	17.8	16.6	16.1	18.1	17.4
Buffalo	20.1	15.6	20.4	13.5	18.2	17.1
Cincinnati	18.8	19.6	14.2	16.7	14.8	14.3
Newark	18.8	16.0	18.4	19.9	15.3	15.6
Kansas City, Mo.	18.3	19.9	17.1	13.1	20.5	18.4
Detroit	17.7	13.4	17.2	14.4	13.7	18.2
Minneapolis	17.7	12.5	10.7	10.1	11.9	11.9
Baltimore	17.1	13.3	13.1	14.6	16.7	13.0
St. Louis	16.9	15.1	13.4	13.7	12.5	9.7
Boston	16.9	13.6	11.8	16.8	14.8	11.5
Cleveland	16.6	17.8	19.2	16.0	22.0	18.6
New York	15.3	15.4	13.6	14.0	12.7	10.2
Washington	14.6	12.1	11.3	13.4	13.1	12.2
Philadelphia	14.1	10.2	12.3	10.6	12.8	9.6
Indianapolis	14.0	12.3	11.3	8.4	8.9	10.5

Of the cities between 300,000 and 100,000 population, Youngstown, Ohio, has the most noteworthy record in having held the record for a high death rate of 30 in 1917 and 31.9 in 1918, and having had a sustained high rate until this year when it dropped to 20.4 per 100,000. Hartford, Conn., and Bridgeport, Conn., and Camden, N. J., have also had a high death rate during these years.

Chamber of Commerce Reports on Transportation

Regulation Through Administrative Agencies—Voluntary Consolidation—Readjustment of Relative Freight Rates—Co-operation Between Rail, Motor and Water Transport

A review of the reports to the Chamber of Commerce of the United States by five special committees appointed to consider various features of the transportation problems of the country. The reports have been issued for consideration in advance of a national transportation conference.—EDITOR.

Public Confidence in Railroad Securities Should be Restored

CONTINUATION of private ownership and operation of railroads in the United States conforms with the American economic system, according to the Committee on Governmental Relations to Railroad Transportation, and the committee thinks that railroad regulation should follow the principle of protecting the public interest and preserving the advantages of competition under fair conditions, while at the same time seeking to give a fair return to capital and fair wages to employees. Both the federal and state governments should consistently follow the principle of regulating the railroads through properly constituted administrative agencies rather than by legislation dealing with specific problems such as rates, practices, and other matters involving railroad operation and management. The committee approves of the recapture clause of the Transportation Act providing for the return of one-half of the surplus above 6 per cent that any railroad may earn upon its capital invested in the transportation service of the country, but it is not convinced that the present requirements which provide for a rate of return of 5½ per cent upon the value of the railroad property is adequate. It points out that the railroad credit has been so impaired in the last few years that investments in railroads during this period have been mainly in bonds, equipment-trust and other fixed-interest-bearing securities until the proportion of such securities as compared with stocks has become dangerously large. This condition can only be corrected by establishing railroad securities on a basis comparable with like securities in other industries.

The committee points out the importance of restoring public confidence in railroad securities so that they will again be able to sell their stock to raise capital for enlarging and extending their facilities, pointing out that if the method of financing followed in the past decade through the sale of bonds and equipment-trust certificates is continued during the next decade most of the railroads of the country will be in a financial position whereby a sudden period of depression would throw them into bankruptcy. In this connection the committee points out that according to its estimate of the new mileage and capital requirements for the next decade (abstracted in *Engineering News-Record*, Nov. 29, p. 896) the railroads will need to raise $8,000,000,000 new capital, exclusive of the capital required for grade-crossing elimination, automatic train control, and other safety provisions made mandatory by legislation.

As valuation is essential to the successful regulation of railroad rates, the committee recommends that the valuation work being carried on during the past ten years be completed at the earliest practicable date. The committee feels that the arrangement whereby the Interstate Commerce Commission has both the power and the responsibility for rate regulation is a desirable arrangement in that it not only gives the commission power to suspend rates that it deems too high but also to raise rates when they are too low. It does not feel that there should be any change in the labor provisions of the Transportation Act, nor does it feel that there should be any changes in any of the important provisions of the act until it has had a fair trial which, at the present writing, it has not had.

* * *

Graduated Tax on Gross Earnings For Transportation Agencies

RADICAL changes in the method of taxing transportation agencies are recommended by the joint subcommittee of the United States Chamber of Commerce on Taxation of Transportation Agencies. The committee points out that the present method of taxing common carriers by ad valorem taxation is largely an attempt to apply the old general property tax, in use in the early days of this country for the taxation of land and simple personal property, to complex and widely distributed economic units, manifestly in form unfitted for such methods of taxation. As a remedy for this condition, it suggests a graduated tax on gross earnings depending on the relation of net to gross as recommended by the New York State Committee on Taxation and Retrenchment. The committee considers this method of taxation as sound in principle and recommends that it be applied to steam and electric railways and as far as practicable to motor vehicles when used as common carriers. Such a tax has the elements of a sound tax in that it has certainty, reasonableness, and simplicity, while at the same time the state in each case will be assured of at least some revenue from each corporation. The tax as applied to steam and electric railroads should replace the multiplicity of taxes at present levied upon them, including federal taxes on the capital stock and income, and the various state and local taxes, such as franchise taxes (of different form in each state), ad valorem taxes, taxes on gross earnings and on capital stock, annual licenses, special franchises, local real estate and personal property taxes. The committee recognizes that there will be some difficulties in allocating this tax to the various political units, but believes that an equitable method of doing it can be devised. It also recognizes that under the diverse bookkeeping methods employed by the small companies and individuals who comprise the bulk of the highway transport common-carrier operators of today, practical administration of a gross-net tax is impossible. Pending common-carrier regulatory control which will place the earnings of these carriers upon

a comparable basis for taxation, the committee believes that such increase should be made in the taxes now levied against common carrier motor vehicles as will bring the charges to an amount equitably proportionate to those that may be assessed against the other carriers. It recognizes that this recommendation segregates common carrier motor vehicles not only from private cars, which have no gross or net earnings, but also from motor trucks used as private carriers and not subject to public control.

The committee frankly accepts the motor vehicle as an essential addition to the transportation agency required in modern economic life. It follows that improved roads to carry these motor vehicles are equally necessary, but the committee draws attention to the fact that these highways must, of necessity, be free to the general public and built out of general public funds, while in the case of steam and electric railways the investment in roadway is a capital account and returns on this investment are paid out of income. On the other hand, the steam and electric railways have certain franchise rights in the use of their roadway. Since the motor vehicle derives a special benefit from the improved highway, the committee believes that it should bear the entire expense of maintaining these roads in as good condition as when they were built, even where this involves resurfacing or reconstruction of the same type of road. In addition to a maintenance tax, highway transport common carriers should pay a tax in exchange for franchise rights comparable to those owned by the other carriers. By the payment of such maintenance costs the motor vehicle puts itself on an equality with the steam and electric railways which pay for the maintenance of their own roadways through direct charges to operation instead of by taxation. The committee does not, however, believe that motor vehicles should be burdened with a special tax for the maintenance of secondary roads which are not suitable for motor use. Finally, the committee states that it would not be performing its full duty if it did not recommend that all possible influence be brought to bear to eliminate wasteful, extravagant, or unnecessary expenditures from the highway program, which should always be subject to centralized and co-ordinated administration.

* * *

Voluntary Railroad Consolidation is Recommended

THE FIRST step in railroad consolidation would, according to the report of the United States Chamber of Commerce Committee on Railroad Consolidation, appear to require the development of a practical basis whereby the twenty-two systems might merge and absorb their various affiliated leased and operated railroad companies and thereby round out their systems and eliminate hundreds of smaller corporations. This step would need to be carefully safeguarded so as to insure as a final result the proper financing and efficient operation of the large consolidated systems. The purpose of the Transportation Act was to encourage such consolidation, but certain provisions of the act have been interpreted in such a way as to delay such consolidation, while, on the other hand, further provisions enable one carrier to obtain control of other carriers either by lease or purchase of stock and yet specifically provide that such control must not involve merging such carriers into a single system for ownership and operation.

The committee states that the purpose and method of the proposed consolidation of the railroads have been misunderstood by many persons. The mistaken supposition is frequently made that the weak roads are to be saddled upon the strong roads and are to be assisted by the more fortunate members of the railroad family. If this were the aim sought by railroad consolidation, there would be little hope of attaining it, nor would it be a justifiable one. The facts of the case are that the weak and strong roads are to unite upon a common footing—that of actual respective values. This will be done by financial readjustment and recapitalization on the basis of earning capacity. If the factor of net earnings and physical values is taken to determine the values of consolidated railroads, and due consideration is also given to such special circumstances as may obtain in exceptional cases, consolidation can be effected in such a manner as to protect the equitable interests of all the roads and to avoid imposing burdens upon any of them.

As the Transportation Act requires that further consolidations of railroads must be approved by and be in harmony with a complete plan of consolidation to be adopted by the Interstate Commerce Commission, the committee recommends that this plan be completed as early as practicable and every facility to that end should be afforded the commission if Congress adheres to this condition set by the act.

The committee also feels that although some of the advantages to be gained from consolidation have been exaggerated, yet the following advantages will be attained by its operation: (a) Development of a limited number of more uniformly strong and stable railroad systems giving the public better assurance of adequate and efficient service at reasonable rates and fares. (b) Simplified and improved rate regulation made possible through more uniformity in the strength and the traffic characteristics of the several systems in each rate district, and permitting more ready adjustment in accordance with the economic needs of the various sections of the country and classes of traffic affected. This will not, however, adversely affect the existing rate-basing points or the established principles of rate making. (c) Economies in construction, maintenance and operation which, while somewhat exaggerated, will nevertheless be important. (d) Improved car service with wider movement of cars on their own systems, a greatly lessened necessity of car interchange, and the utilization of more direct routes, better grades and shorter hauls. (e) Preservation of competition in rates, subject, as at present, to the limitations imposed by government regulation, and maintenance of competition in service or often the enhancement of competition through rivalry between systems of relatively equal strength.

The committee feels that a full opportunity should be given the carriers to consolidate by voluntary action as compulsory consolidation will involve so many constitutional questions and is such an intricate and involved proposition that it might hinder rather than promote consolidation. It also recommends that the proposed consolidated companies should preferably be chartered by the federal government. It is not, however, necessary to insist upon federal incorporation which might be regarded as undesirable by the states or by par-

ticular carriers that fear to lose certain valuable rights that they possess under their state charters. Indeed, the states themselves might lead the way by enacting liberal and uniform laws removing the difficulties and cost of consolidating the existing railroad companies.

Finally, the committee does not recommend any changes in the consolidation provisions of the Transportation Act at the present time, but it thinks that experience will indicate the need of supplementary legislation in relation to (a) joint ownership of lines, (b) exchange or re-issue of the securities of existing corporations instead of creating new consolidated corporations, (c) authority for dealing with minority stockholders, (d) exemption from taxes on security issues or exchange involved in the consolidations or mergers provided they do not exceed at par the par value of the existing stocks and bonds of the present companies, and (e) the creation of suitable agencies to promote and supervise the working out of consolidation.

* * *

Co-ordination of Highway, Rail and Water Transportation

TWO COMMITTEES dealt with the separate phases of co-operation between the rail, motor and water transport of the country, one dealing with the relation of motor transport and the railroads, and the other dealing with the relation of water transport and the railroads. The report of the committee on motor and rail transport was abstracted in the issue of Nov. 22, 1923, p. 862. Both committees think that if the transportation needs of the country are to be adequately met there must be co-operation and not competition between the three principal modes of transportation. In general, they are of the opinion that rail and water transportation can handle bulk freight to best advantage over long hauls and that motor transportation can be used to advantage between rail or water terminals and individual shippers, and for short-haul traffic in areas where there is not sufficient traffic to warrant the operation of a railroad. In effect, the motor transport should be developed as a feeder for the trunk transportation system. The committees also feel that by a proper adjustment of rail and water rates, and by the provision of proper facilities for the interchange of freight, water transportation can be used to advantage for handling bulk commodities over long distances in all parts of the country where navigable streams or artificial channels exist.

Augusta Unlikely to Get Channel to the Sea

Augusta, Ga., long has enjoyed water-compelled rates because of the potential navigation existing between Augusta and Savannah. Recently the carriers withdrew the low rates. This resulted in a visit to Washington on the part of a delegation urging the improvement of the Savannah River to the extent of providing a 5-ft. channel. Such a project was adopted many years ago. Under that project the securing of that depth was to be accomplished by regulating works. It is the opinion of the district engineer, however, that such works would not give a year-around 5-ft. channel. He is convinced that locks and dams will be necessary. The Board of Engineers for Rivers and Harbors heard the arguments of the delegation, but it was evident from the questions asked that they doubt that the volume of commerce will justify the cost of this improvement.

Herbert Hoover on the Railroad Problem

IN HIS annual report as Secretary of Commerce Herbert Hoover discusses the problems of rail rates and railroad consolidation in the following paragraphs:

The difficulties of reorganizing the railway rate structure so as to secure simplification and to give relief in primary products—agricultural, coal, etc.—by a fairer burden upon finished and LCL goods are almost insuperable until the different systems are possessed of more diversified traffic and until the weaker roads have been absorbed. The necessity to establish railway credit and finance on a broader foundation than sole reliance upon the issue of mortgage securities; the necessity of provision for common utilization of terminal and other facilities; the impossibility of providing adequate rolling stock and particularly specialized cars so long as the burden falls solely upon the strong roads; the difficulties of more definite control of car service to meet seasonal demands and routing; the insuperable problems of equalization in car interchange; the slow progress in standardization and maintenance of equipment—all point to the imminent desirability of early progress with consolidations.

The idea of protection against excessive railway rates through the maintenance of competition is now dead. We should therefore secure the largest possible benefits from consolidation into larger systems by securing consolidation in such fashion as will protect and advance public interest.

The urgent importance of the early consummation of consolidation warrants consideration of methods to expedite it. Under the present provisions for wholly voluntary action subject to the Interstate Commerce Commission, many consolidations are likely to be long delayed. The difficulties of negotiation between the members of the groups that will be established by the Interstate Commerce Commission; the complications arising from varying priorities of securities affecting the determination of terms of purchase by one railway line of the property of another; the unwillingness of some lines to acquire or to sell others; the questions of individuality; the difficulties of establishing by negotiation the relative value of one property to another; the necessity of holding capitalization within the limits of the actual property values; the complexities and conflicts of state regulation and laws—all these problems would find a great measure of solution if the consolidated systems were allowed federal incorporation and if after a lapse of some appropriate period for voluntary action the Interstate Commerce Commission were given authority to create definite organization committees for each system including representation from the public and the component roads.

It should be the duty of such committees to develop and perfect a plan of consolidation either through the exchange of securities of the consolidated systems directly with the security holders of the component roads or by some other method. I believe that under such auspices the security holders would be willing voluntarily to make such an exchange. If a minority should refuse, it would be entirely feasible to invoke condemnation and purchase of their securities for the consolidated systems at an established fair value. Such a method would permit the determination of the relative value of the different railways considering both the physical properties and the often lower total of their securities, and due account could be taken of future as well as present conditions.

The ownership of some roads or terminals jointly by two or more consolidated systems could be provided for, as there are cases where such a solution would be most advisable in creating more efficient transportation. The public interest could be safeguarded by limiting the total capitalization of consolidated systems to an amount not exceeding the physical value of the railways as determined by the Interstate Commerce Commission under the Transportation Act as of June 30, 1914, plus actual capital expenditures and deducting abandonments and depreciation since that date. The total capitalization of many of the consolidateed railways would probably be less than the Interstate Commerce Commission physical valuation and certainly less than their present nominal capital.

Federal Land Reclamation: A National Problem

8. Faults of Reclamation Law and Practice, and Their Remedies

The Eighth of a Series of Articles on the History and Performance of the Great Government Adventure in Irrigation of the Arid Lands of the West

By THOMAS H. MEANS

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WHEN the Reclamation Act was passed in 1902, irrigation was being practiced in all western states, but in only a few places was it profitable to the builders of the works. In parts of California, in the Mormon settlements of Utah, in Colorado, and in other places irrigation was successful, but on the whole the results were discouraging in the strictly desert areas. Private capital invested in irrigation enterprises had not paid, though the estimated profits were large. In many cases the losses both to builder of works and to farmer were serious. Such were conditions at the time the federal government entered the field.

Accomplishments—The 20th anniversary of the passage of the Reclamation Act occurred last year. In twenty years the government has invested in 26 projects $136,000,000, and has collected $13,000,000. The farmers have harvested eight million acres of crops valued at $528,000,000. In 1921 there were 31,462 farms in operation, covering 1,158,000 acres, producing $50,000,000 in crops. This briefly outlines the accomplishments; but the measure of success cannot be given in acres or dollars alone.

The Act placed a fund in the hands of the Secretary of the Interior to be used in the construction of irrigation works. The land benefited was to bear a water right charge which was to be returned to the fund in ten annual installments. This revolving fund was expected to provide ample funds for future reclamation projects.

The objects of the Act, to provide homes, have been accomplished. A large area of land has been reclaimed, many farms have been developed and the reclamation projects today represent as thrifty a part of America as is found in any region of the West. The yields of crops and returns per acre are better than the average in the states in which these projects are located. The farmer on the project is a little more successful than the average farmer in his state.

Collection of repayments has been less completely accomplished. Early in the history of the Service it was found that the collection of money in ten annual installments was impractical. The class of farmers attracted to the projects had little capital and that was needed to pay living and development expenses until the farms became productive. Efforts to collect money resulted in appeals to set aside or reduce the payments. Various amendments were made to the Act until now the time has been extended to twenty years. Each extension of time or adjustment was made after an investigation by Congress. In 1922 the Service reported that 85 per cent of the moneys then due had been collected. As the time covered by the records of collections included the period of low agricultural prices following the war it is a record to be proud of. Few business ventures can show better results.

Some Handicaps—Yet there have been many places where more rapid advancement could have been made under different conditions. Handicaps of various sorts delayed the administration of the Reclamation law. Some of these are inherent to government activities, others can be removed by intelligent action by Congress.

The law itself seriously handicapped the progress of reclamation. It was a most general law, containing few details and leaving management in the hands of the Secretary of the Interior. Washington bureaus have for many generations been operated upon the theory that anything to be legal must be specifically authorized in the law, and in the execution of a general law such as this the old officers, who usually advise the Secretary, found it difficult to depart from time-honored customs.

As examples: The Land Office with a hundred years of red tape handled all land matters and was many times a stumbling block in the way of businesslike administration. The Treasury Department, whose auditors were unaccustomed to ordinary business practices, was frequently shocked by being asked to do things in a direct and businesslike fashion. Many other bureaus, whose co-operation was required by the new and vigorous service, were horror-stricken to find an attempt being made to carry out a job in about the same fashion that any business man would do it.

But the most important handicap of all was the Secretary of the Interior himself—the man who is authorized by law to "perform any and all acts and to make such rules and regulations as may be necessary and proper for the purpose of carrying the provisions of this Act into full force and effect." The Secretary of the Interior is a very busy man. He is seldom acquainted with the problems of the West. He was often not in sympathy with the activities of the young organization. He was usually inclined to listen to the man who complained of hardships and to think the hardships were caused by the Service. He seldom knew how to get facts which were unbiased. As a result the incoming Secretary often became convinced that something was wrong with the Reclamation Service and held back his official approval on many activities until he could have time to investigate the condition of affairs. This has resulted repeatedly in delays, and some of the most distressing incidents connected with the Service history are due to this one condition.

Garfield's Vision—One Secretary held a different view from the others. Secretary James R. Garfield, in Roosevelt's administration, had the belief that he was authorized by Congress to accomplish the purposes of the Reclamation Act and that anything required toward that end was to be done, unless it was specifically forbidden by law. His view, so directly opposite to the older departmental ideas, enabled the Reclamation Service to get a start in life and to establish the much needed precedent for later secretaries to follow. Perhaps no one man is more entitled to credit in the early days of the Service than Secretary Garfield.

As an example of his methods: The Land Office had decreed that there was no way of preventing settlement upon any reclamation project before completion of the ditch. The result was that settlers scattered over the whole project and often outside it, requiring the construction of canals and ditches of great length to supply small isolated areas of land. The Service had endeavored to open projects by units, so that settlement could be completed in one area before more distant lands were irrigated. It was only through Secretary Garfield's personal investigation in the field that this much needed reform was brought about. He directed the withdrawal of all land and the opening to entry of only such tracts as were ready for water. No new law was required to do this. The only thing needed was a secretary with the backbone to follow the recommendations of the Director of the Reclamation Service.

The State Apportionment Evil—The Reclamation Act provided for the establishment of projects in all sixteen western states, the intention being to expend the major portion of the funds arising from the sale of public lands within each state, within that state's limits. Within each ten-year period the expenditures were to be equalized to the extent of 51 per cent of the fund among the several states. In the border states in the semi-arid belt—North Dakota, South Dakota, Kansas, Nebraska and Oklahoma—the funds were large, and the opportunities for irrigation small; in an effort to comply with the law the Service spent a large amount of time and money to find feasible projects, but feasible projects have not yet been found.

This allotment of funds by states caused a great deal of political activity. The result is that we have now some projects which, though completed, have never been successfully operated. The pumping plants in North Dakota are examples of this.

"Lame Duck" Projects—Later in the history of the Service many projects which had been started by private capital were forced upon the Service in order to save struggling communities from extinction. In some cases these projects were afterwards made successful, in other cases success has not attended the efforts of the Service. As an example of the former, the Sunnyside tract of the Yakima River in Washington was taken over after fifteen years' effort on the part of the owner, the Northern Pacific R.R., at a time when both the farmers and the railroad were thoroughly discouraged over the lack of success of irrigation; the project has since become one of the most fertile and profitable in the West. On the other hand, in other states, projects taken over when on the road to failure have not succeeded. In these cases the Service was strongly urged to save the community and through political efforts forced to take over the completion and management of the project. There are today many other projects on which the farmers would be fortunate if they could get the Service to do likewise. These "lame ducks" should be regarded as evidence for, not against, the Reclamation Service.

In addition to these handicaps the farmer upon the Reclamation Service project was frequently no great asset. The announcement that the government was going into the business of irrigating lands and that there was a free home for every man in the West attracted the attention of all classes of people. The inevitable result was that many who were failures in other walks of life and many incompetents flocked to the projects to take up land and reap the benefits of this munificent plan. Farming requires energy, skill and perseverance. Irrigation adds nothing to the ease of farming, in fact it requires a higher degree of skill. The quality of the settlers cannot be blamed upon the law; it can only be blamed on the inability of any governmental agency to select its settlers as would any private agency.

Administrative Errors—Handicapped as it was by the law and the precedent of Departmental rule, there is little wonder that the administration by the Reclamation Service was deficient at times. But the successes so far overbalance the failures that a fair-minded man finds little to criticize. It should be remembered that we are looking backward and in the light of events many things now appear clear. We see the reason why some things did not succeed. In other cases a turn in the tide has worked success out of a potential failure.

On the passage of the Act and organization of the Service there was a grand scramble for the money by all the western states. The end of the first year saw a fund of nearly $5,000,000 available. Congressmen and politicians of other kinds besought the establishment of projects in many places. Attempts were early under way to have Congress direct the places where money was to be spent. The engineers were urged by those who knew the results of pork barrel appropriation to make the dirt fly. They did. Preliminary surveys made by organizations in charge of earlier investigations served to outline several possible projects, such as the Salt River dam, now the Roosevelt, in Arizona. Senator Newlands, of Nevada, had caused preliminary surveys to be made at his own expense of what is now the Newlands project. In the latter case a survey was at once commenced. In the Salt River Valley the land was so largely in private ownership that the organization of the land owners was necessary and that took time. Other projects were speedily outlined and the fund was allotted to keep it from being looted by promoters of questionable enterprises.

In its haste to nail the fund down, it is possible that the Service did not select the projects most desirable at that time, but there is no question but that it was necessary to allot the fund, for the mere sight of a pot of unattached money attracted too much attention. Throughout the history of the Service this has been true. At the present time there is an alleged eleven millions in the fund and many hungry eyes are directed toward it. The dismissal of Arthur Davis is in part attributable to the disappointed hopes of certain aspirants for the honor of spending this money.

Great difficulties of other kinds attended the selection of projects. Not so much was known about arid soils as now, hydrographic information was meager, we had little appreciation of the economics of agriculture in certain of our western valleys. Looking backward we now see that there was little chance for the farmer to make a success in certain western projects except by producing feed for cattle. The development of potato growing in Aroostook County, Maine, was a factor in making potatoes unprofitable in Idaho, but who could have predicted that twenty years ago?

The selection of projects was not left to a calm analysis of engineering facts. Influential citizens, big railroads and state senators often were a factor, as well

as soils, climate, water supply and market facilities. Certain Montana projects were strongly urged by Senator Carter while he was Chairman of the Senate committee on irrigation; transcontinental roads liked to have projects on their lines because of the increased revenues it gave them, and many and devious were the ways in which their wishes were made to come true. On the whole, however, the projects selected were such as would be successful. About the only project selected in which a mistake in engineering was made was the Hondo project in New Mexico, where the reservoir site, underlain by limestone and gypsum, was so leaky that it has never been filled.

There has probably never been any large undertaking so free from engineering mistakes. From being a beginner in irrigation the United States has become the world leader, and it is almost entirely the work of the Reclamation Service which has brought about the change. If any criticisms can be offered of the construction work of the Service it is that the work is too well done. There has probably never been any large public work, either governmental or corporation, which received so much for the money spent as the Reclamation Service. One reason for this is that the work has gone on long enough for a competent construction organization to have been built up. The newspapers now announce that the new plan is to go back to contract work. After twenty years' effort to build up an efficient construction organization, that is to be scrapped and a new method tried. Oh well, Uncle Sam is rich!

Faults of Management—Recent changes in the Service personnel by Secretary Work were made because he wished to place the management on a more business-like basis. He replaced a manager of twenty years' experience with one without experience, so far as one can learn from his past record. It is of interest to see what was lacking in the management of the business and what changes for the better are to be hoped for.

The reclamation law places the entire responsibility for the reclamation work upon the Secretary of Interior. He is, as we all know, about the busiest of cabinet officers. He selects the head of the Reclamation Service. Heretofore he has had little to do with the detailed organization, but all matters of policy must be approved by him. The executive head of the organization was the Director.

Under the Director were the appropriate legal and engineering staffs and on each project were engineering, construction, clerical and operating organizations. Administrative headquarters are in Washington, with engineering and operating headquarters in Denver. Management has to do with investigation, construction, settlement and operation of projects. At various times during the history of the Service changes in organization have been made; sometimes as the result of experience of the officers in direct charge, other times by the Secretary of Interior against the recommendation of the Director. As an instance of the latter, Secretary Lane placed management in the hands of a commission of which the Director was a member.

In the investigation preliminary to project construction, the Service has had the assistance and advice of the Department of Agriculture, the Division of Hydrography and other organizations which collect and digest facts. In the early days the information available was less reliable than now and on a number of projects we see the results of this lack of information. For example, on the Newlands project large areas of alkali land were at one time thought reclaimable and ditches were built to water such areas. On the Klamath project an area of marsh land included in the original project was found to be of questionable value. Little money was spent on its reclamation, however. At Umatilla, Ore., an area of very light sand has been difficult to farm, though it is proving very fine land when once in crop.

Land examination was made of the projects early in their development. An effort was made to exclude all land of poor quality. Sometimes this examination failed to reveal the true character of the land and in a few cases the field examiners were overruled and land included which afterward proved worthless. Though mistakes of this kind occurred the area of land thus involved was very small as compared with the whole area, and the amount of money involved is but a small percentage of that spent. Such errors are common in any human endeavor; they occur in every enterprise, whether government, corporation or individual. There is now more reliable information about soils, water supply and agricultural possibilities of western soils, and future projects may profit by past experience.

Drainage—The difficulties caused by lack of drainage facilities are probably as often quoted as evidence of mismanagement as any other feature of our federal reclamation. Drainage problems accompany or follow irrigation nearly everywhere through the world. The reclamation projects have been no worse than most private projects. They should have been better. In the early days of project irrigation the lands seldom showed any signs of needing drainage. In some places the water table rose rapidly and damaged land before any remedy could be applied; in other places drainage was developed as fast as the need arose. The need for drainage arises where more water is applied than the land can absorb or the plants use; the greater the use the more necessary the drainage. Reclamation projects attempt to provide full service of water in all seasons, in other words, water is always available for use. Had the lands not had an abundance of water no end of criticism would have followed.

In order to be fair to the farmer water in abundance is provided. In this respect the Service has sometimes followed the easiest road rather than the best. Too much water is the greatest misfortune which can overtake an irrigated community. In fact what the farmer regards as enough water is generally too much. The greatest blessing to an irrigated community is a reasonable deficiency. With a deficiency the farmer is required to handle his water with more care and the results are better crops of better quality and less damage by waterlogging. It is less work to irrigate with careless methods—easier to apply a large amount than to spread just enough water uniformly. The water user likes lots of water so he can irrigate the easiest way, and as that is the wasteful way he wastes water.

The Service has done a great deal to encourage economic use. It has arranged schedules of prices so that excessive use is costly, and in other ways has tried to encourage economical irrigation, but it did not succeed until much land was already damaged. Many are inclined to censure the officials for this. A knowledge of the inside facts, however, shows the engineers in a constant endeavor to encourage economic use of

water. Lack of co-operation on the part of the water user was nearly complete. Nothing short of a kindly providence bringing dry seasons in a row has ever effectively taught any considerable number of American farmers economy in use of water.

The inevitable result of the wasteful use of water was a need of drainage. Drainage problems arose in many places. Usually the project was completed and the construction cost assessed to the land before drainage problems arose. No method of collecting money from the land was available and there was in some places a delay in getting drainage started. All of this has caused criticism of the Service. Congress could have corrected the matter at any time by appropriate legislation, which was recommended by the engineers of the Service.

Problems of Settlement—The success of an irrigation enterprise rests with the man who farms the land, not with the builder of the works or the operating engineer who delivers the water. The farmer makes success or failure. With good soil, a climate suitable for crops, a regulated supply of water and a market for produce, it would seem that the project could not help being a success. Such is not the case, however. The man who farms must know how to farm, must be diligent, hard working and businesslike. If any considerable percentage of the farmers does not have these qualities the success of the project is endangered.

Money is as essential as energy and experience to the farmer who takes up a reclamation farm. The amount depends upon the individual; it is the rare man who can succeed with two or three thousand dollars. Irrigation farming does not attract the man with money. Too many men without adequate cash have taken up farms on projects. There is no way for the government to select settlers. Any one with his homestead rights and enough cash to make a first payment can take on the responsibilities of making a farm out of a desert homestead. In the early days of government reclamation a land office fee of $8 or $10 was all the cash required. Secretary Garfield was persuaded that it was good business to require an advance payment of a year's water charges. This served to eliminate the man entirely without money, but it gave no assurance of future payments. The projects too often have been settled by men without adequate resources. This condition is not peculiar to government projects; all western colonization in recent years has suffered from this difficulty. This lack of funds resulted in many farms being slowly developed.

The time of payments to the government is set by the Secretary of Interior under the law. The settlers whose payments were due commenced an approach to the Secretary and Congress in hopes of relief. This advance took place in many forms and usually took place regardless of the ability of the farmer to pay. The small politician talked of it, and the larger politician asked votes on the basis of securing help for the poor farmer. The Secretary, hearing all of the noise about inability to pay (the man who could pay kept quiet) usually started an investigation into the real merits of the contention. Congressional committees went through the West to listen to protests from farmers on reclamation projects. In one case a questionnaire designed to bring out all complainants was sent out a few months ahead of the congressional investigating committee. The results of this agitation caused a general feeling that the farmers of the projects intended to try and get out of all payments. There is yet some doubt as to the real intentions or hopes of the average reclamation project farmer.

Farmers have had more help from the government than any other class of people. So many bureaus and experiment stations have been supported by the government in order to teach the farmer how to attend to his daily business that he has become a little self-conscious. Anything affecting his welfare is made the basis of political activity. The farmer on reclamation projects had no more need for consideration than any other western farmers. He had good irrigation works, a better regulated supply of water, and no interest to pay on his water charges. However, he has been led to believe that the money he owes to the government will be remitted or at least his payments will be delayed if he makes enough noise. He has never failed to make a noise.

It is really a wonder, in view of all this array of political, legal and administrative obstacles in the path of reclamation, that anything worth while was accomplished. The results speak for themselves and reflect great credit upon the qualities of the responsible officers of the Service.

A discussion of this sort adds little to our knowledge unless from it suggestions can be drawn for better practices in the future. The following suggestions are offered:

What Can Be Suggested for the Future

First of all we agree with Secretary Work that the reclamation policy must be placed on a businesslike basis. This does not mean the disruption of a valuable *esprit de corps* by the summary dismissal of a valuable man and a belated endeavor at fact-finding to determine why he was dismissed, but it means the following things among others:

1. Projects should be approved on the basis of their feasibility. Neither state lines nor political preferences should have any weight in the selection.

This has been the endeavor of the Reclamation Service at all times. Any departure from this rule has been caused by someone outside of the Reclamation Service.

2. Before final approval of projects, these things should be assured:

a. Sufficient good land to stand the charge.

b. Water supply unfailing in quantity and of good quality.

c. Climatic conditions such that crops of value high enough to both support the farmer and enable him to pay his charges for water.

d. Location such that freight rates permit the shipment of its products to an established market with fair returns to the grower.

e. An economic need for the new agricultural area.

3. The charges for water should be assessed to the land in proportion to the benefits, not on a flat rate per acre as now.

This will permit the inclusion of poorer tracts of land which can be used for pasture or some other such use. The assessing of charges on basis of benefits will remove many of the inequalities which now result in abandonment of land.

4. The construction charge should not exceed a sum which the farmer can pay out of the proceeds of his farming operations. *This charge should include interest* upon the unpaid balance.

The lending of money without interest is the fundamental error of the reclamation law. There are today worthy projects, in regions where agricultural development is needed, which will cost more than the farmer can afford to pay. In such cases Congress should appropriate money for the excess, charging the farmer with the amount he can afford to pay.

5. The time of payment should vary with the project. A California project may be able to pay faster than one in Montana. A period of no payment but interest should be required in the early years while the farmer's resources are required to bring his ranch into full development.

6. Settlers on public land and owners of private land should be required to show financial strength sufficient to place the farm on a paying basis.

7. Sale or transfer should only be permitted when the financial obligation to the government is completed or when the new owner is financially as sound as the former owner.

8. Operation and maintenance charges on unoccupied public land should either be paid by the government or added to the construction charge so no unfair burden be placed on early settlers.

9. All affairs connected with the details of project management should be placed in the hands of the farmers as soon as possible—preferably through Irrigation Districts.

10. Provision should be made for technical agricultural advice and co-operative handling of products through the Federal Department of Agriculture and state organizations. The farmers should help pay for this advice. Free advice like other free things is usually valued at its cost.

11. Endeavor should be made to cause the reclamation farmer to stand on his own legs, fight his own battles and, when hard times come, as they do to men in all walks of life, work out his problems as other men have to do. Blessed is he that doth not bellyache.

Relocation Avoids Large Trestles and Sharp Curves

LINE IMPROVEMENT and elimination of long and high trestles will be effected by a short stretch of relocation now in progress on the Algoma Central & Hudson Bay Ry., near Frater, Ontario. At this point (Miles 103.8 to 104.79) the line is about 750 ft. above Lake Superior and four miles from the shore of Agawa Bay, with two trestles spanning coulees high up on the range of hills which fronts the lake. A view of the big trestle is shown in Fig. 1.

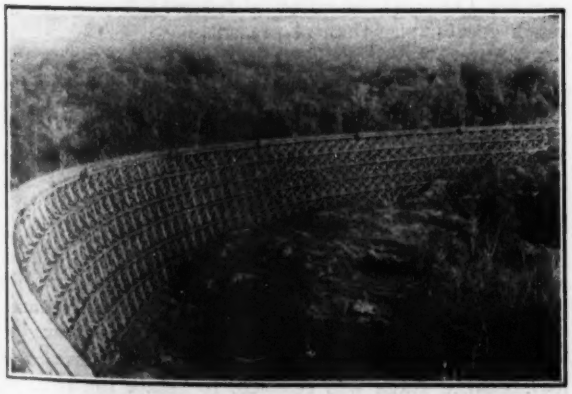


FIG. 1—LARGE FRAME TRESTLE TO BE ABANDONED

Both trestles are of frame construction, built in 1911-1912. The larger one is 1,050 ft. long, and 75 ft. high, on a 12-deg. curve, with a central angle of 139 deg. The other trestle is 520 ft. long, 60 ft. high and mainly on tangent. Relocation for about one mile is being made to avoid the risk of filling such large trestles, but at the same time it will shorten the line by about 500 ft. and eliminate five 12-deg. curves, reducing the curvature by 201 deg. 42 min. This relocation is shown in Fig. 2. The grading will be mainly in solid rock, with three large cuts.

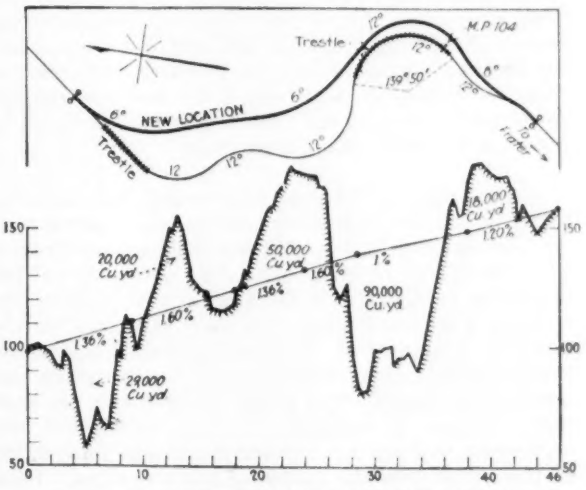


FIG. 2—LINE REVISION ON CANADIAN RAILWAY

The contract for grading has been let to McNamara Brothers & Thornton, Sault Ste. Marie, Ontario. Tracklaying will be done by company forces. It is expected to have the new line completed by June, 1925, after which the old track and the trestles will be salvaged. The cost is estimated at $187,000. B. E. Barnhill is construction engineer in direct charge, while the work is under the general supervision of L. C. Maxwell, engineer maintenance-of-way, and R. S. McCormick, chief engineer and general superintendent of the Algoma Central & Hudson Bay Ry.

Irrigation in India

The total area of land irrigated in 1922 by all classes of work in India, exclusive of the Indian states, was approximately 43,125 square miles or 14 per cent of the cultivated area, according to a report issued by the Department of Industries and Labor, Government of India. The irrigation districts are distributed in twelve provinces. Extensions and new works are being made continually and hydro-electric projects are proposed in connection with some of these. Thus the Bhandardara dam to be completed in 1924, with a total height of 270 ft., will provide for 5,000 hp. and the Bhatgarh dam, 190 ft., to be completed in 1926, will provide for 3,000 hp. Both of these works are in the Bombay province. The estimated value of crops on all areas receiving government irrigation was more than double the total capital expended, while the returns on capital invested in productive projects ranged from 7.76 to 14.63 per cent. All of this work, both as to construction and operation, is under the Public Works Department of the Government of India.

Highway Officials Review Technical Activities of 1923

Papers and Discussions at New Orleans Meeting Stress Research and Administration — Construction Practices Get Second Consideration—Maintenance Neglected

Engineering News-Record Staff Report

PROFESSIONAL topics of unusual variety were reviewed in formal papers presented at the New Orleans convention on Dec. 3 to 6 of the American Association of State Highway Officials. These papers are here summarized under the heads of administration turnover, federal-aid, design and research, finance and construction. Incidentally, this grouping indicates the range of knowledge with which the modern highway commissioner and engineer must keep in close touch in directing the work of his department.

Administration Turnover—Charging the fault to highway officials themselves and to the inactivity of the association, H. G. Shirley, chairman, Virginia State Highway Commission, called attention to the dangerous turnover in department administration. In the last two years there had been a change in the directing personnel of 24 state highway departments. Road administration, construction and maintenance had advanced so rapidly that public thought had not kept pace. Failure to recognize this lag in thought and an attempt to force the pace and consequent antagonism of the public were the causes of many changes. Political interference was not a major cause. With ordinary firmness political interference in highway administration could be prevented by the department head. It was important to keep in line with public sentiment—to lead the thinking of the people, but not arbitrarily drive ahead with policies they had not been educated to approve. Once the confidence of the public was secured by leading and not by driving, its support could be had for any reasonable plan of highway development and political interference need not be feared. Education of the public had been backward.

Men who are capable of directing and handling expenditures running into approximately $1,000,000,000 yearly should be of such a type as to command serious thought before any change in personnel was made. To handle so much capital there must be a stated term of office. This permanence of position was necessary to attract able and honest men. A change in the directing heads of 24 state highway departments in two years did not indicate such permanence of position. The fact that this turnover has not been protested indicated that the association was remiss in serving its members. Indeed, the fault lies in the fact that highway officials "have not brought to the attention of the public the great need and importance of continuous services for such offices in keeping with the offices of our railroads and other large organizations."

Interesting statistics of administration turnover were presented by H. K. Bishop, Bureau of Public Roads, in discussing Mr. Shirley's paper. During the eight years of federal aid, or from 1916 to 1923, 48 states have had 117 chief engineers of highway departments. Of these chief engineers 34 served one year, 35 served two years and 13 three years. The average official life of a chief highway engineer is approximately three years. Stated in a different way ten of the 48 states retained the same chief engineer for the eight years, 19 had two chief engineers during this period, 14 had three, three had four and two had five.

Federal Aid—Selecting a federal-aid system of highways was reported to be substantially completed, by Thomas H. MacDonald, chief, Bureau of Public Roads, who gave credit to state road officials for remarkable co-operation. The officially-recorded road mileage of the country is 2,886,000. State systems aggregate 220,000 miles of which 80,000 miles are surfaced. In the past four years more miles have been surfaced than in all previous time. Withal, road improvement is lagging far behind traffic development. Completion of the federal-aid system in ten years calls for 11,000 miles of construction each year. Mr. MacDonald cited the need of extended traffic studies. There were needed uniform traffic regulations, more department testing laboratories, regular reporting of accidents, and better engineering inspection of road construction. Only 36 per cent of all road expenditures was provided by property taxes and only 11 per cent of all taxes were for roads. Only 40 per cent of the expenditures for roads was under state or federal control. Motor-vehicle license taxes and gasoline taxes should be for road improvement alone. Present expenditures, large as they seem, were small compared with the value received. Grade crossing elimination was a vital necessity. Of 753 eliminations on federal aid roads 62 per cent were accomplished by road relocation and 38 per cent by grade separation. Calling attention to troubles already experienced it was urged that no state should accept contributions for road improvement unless entirely without restrictions. For future practice, unstable subgrade soils should be stabilized by adding some material as sand, gravel or cement. The outlook should be for a general raising of standards by research, more strict routine testing, better engineering inspection, better design and construction.

Calling attention to existing federal-aid funds W. C. Markham, executive secretary, noted the necessity for approaching Congress at the current session for action on the future federal-aid program if there were not to be a hiatus in federal-aid appropriations. It was pointed out that failure of states to take up their allotments of federal aid put difficulties in the way of getting Congress to adopt a federal-aid program of much greater size than at present.

Design and Research—Premising that research which which was not applied practically was of scant value, Charles M. Upham, chief engineer, North Carolina State Highway Department, described the development through experiment of the near-macadam roads and sand-asphalt roads of his state, in which there is a large mileage of top-soil or natural sand-clay roads. These roads have great strength, they will carry almost any load without breaking down, but they wear rapidly by abrasion and after traffic exceeds about 400 vehicles per day the maintenance, because of surface wear, becomes excessive. The problem was, when the excessive maintenance stage was reached, to retain the original

strength element and strengthen the surface to resist wear without going to hard pavement—that is, to provide an intermediate road between the original top-soil road and a paved one. Asphalt could not be applied to the old top-soil surface because a dust layer formed underneath and the asphalt peeled off. Also, it was observed that stone embedded in the old top-soil was held rigidly. Asphalt could be applied and would stick to the stone. Experiment was based on the last finding. The old top-soil was scarified and spread with one layer of 3½-in. stone which was rolled until embedded half depth in the loosened top-soil surface. Then asphalt, about 1.6 gal. per square yard, was applied and a layer of smaller stone spread and rolled. Finally, a light dressing of asphalt was covered with small stone and rolled. The result was virtually a bituminous macadam armor over the old top-soil road. These roads are standing up under a heavy traffic and their cost is half that of pavement.

The sand-asphalt construction is the result of another experimental study to utilize local materials. In certain sections there is only sand and no other material to be obtained except by extensive haul. The trial road was built as follows: The sand was graded and rolled with a grooved roller between timber side forms. An asphalt mixture of about 92 per cent sand was laid on the rolled grade and on this a surface of approximately sheet asphalt mixture. The cost of this type of road was less than half that of ordinary black-top roads.

Continuation of the Bates road test, using sections with thickened edges, was described by Clifford Older, chief engineer, Illinois Department of Public Works. These edge-thickened sections showed no failure under legal loads for 9-6-9-in. and 9-5-9-in. slabs, and no considerable damage under 13,000-lb. wheel loads. Several diagrams of repeated load tests 6 lb. per square inch in Illinois clay soils were exhibited.

Observations on tests and materials for concrete road construction by G. W. Hutchinson, of North Carolina, discussed by A. T. Goldbeck, Bureau of Public Roads, were presented in a series of diagrams too extended to be considered in the present report.

Finance—The tendency of recent legislation in regard to financing highway construction was reviewed by J. N. Mackall, director of the Department of Public Works of Maryland.

Salient features of Mr. Mackall's discussion follow:

The alarming thing about the recent tendency in the financing of highway construction and maintenance is the extent to which automobile license fees and the gasoline tax receipts are being used to finance relatively long-term bonds for construction. If the excess of receipts from the motor-vehicle user over the maintenance cost were used annually for construction, certainly it could not be criticised by any man. To do this is the best of business, but to issue bonds running over a long term of years, and set up as the first call on the receipts from the motor-vehicle user sufficient to pay interest and amortization on these bonds is insuring that the proceeds from the current receipts from the motor-vehicle user cannot be used for road maintenance as the need for road maintenance and reconstruction continues.

Many roads, in fact most of the paved roads today, are being built of concrete. The cost of maintenance of these concrete roads is a relatively small amount and will remain so for a number of years, but who will say that bonds running for terms of even 15 to 25 years will be retired before the best of concrete roads will require extensive reconstruction and maintenance. One of the greatest calamities which could befall the transportation program of any state would be to find that there were not sufficient funds from current receipts to maintain in perfect condition roads previously built from bond issues or from current receipts.

It is fundamental that all maintenance and reconstruction be cared for from current receipts, and it is equally as fundamental that no prior charges be made against the prospective current receipts which could in any way prevent these current receipts from coming in sufficient volume to pay the maintenance charges on all the improved roads in the state. Representatives of the automobile industry have argued time and time again for the issuance of long-term bonds for road construction and at the same time have admitted that the responsibility for the maintenance of these roads was and should rightly be the responsibility of the user, but the greatest difficulty in this arrangement is the practicability of financing such a plan. If any community cannot raise with reasonably short-term bonds sufficient money for the original construction of its roads, that same community cannot in 10, 15 or 20 years become sufficiently prosperous to pay for the reconstruction of these roads from current receipts. If reasonably short-term bonds, say, on the serial annuity plan, fully matured in 15 years cannot be financed by a community from its general taxes, how is this same community going, in 15 years, to pay interest and amortization and in addition an annual maintenance cost much greater than this. Yet the automobilist has admitted and the automobilist does admit that it is his sole responsibility to pay for the maintenance and reconstruction of roads, and it can with considerable propriety be argued that this is the full measure of his responsibility.

Construction—Characteristic mid-western practice in gravel road construction was outlined by John H. Mullen, chief engineer, Minnesota Highway Department, as follows:

Gravel surfacing as practiced in the middle west is rather different than the methods of gravel road building prescribed in the text books. Trenching and the placing and rolling in layers of different sized gravel has been found to entail needless expense and a system has been developed which is in reality a combination of construction and maintenance, and consists, briefly, of spreading gravel on the roadbed and compacting it under traffic and maintenance. This sounds rather crude but it is a method which has been found to be the most economical after considerable experience in various systems of handling the work.

Subgrade is the first consideration and when bad sand is encountered a sand-clay crust is first built, or if the grade is composed of muskeg or unstable mucky material. a covering of clay is applied to sustain the gravel wearing course. The subgrade for graveling is bladed to practically a flat section with never more than a 4-in. crown on a 30-ft. roadway. Hauling is usually done with trucks, material being dumped in a ridge at the rate of 22 to 36 cu.yd. per station, depending upon the traffic to be served, the kind of gravel, and the material in the subgrade. The gravel is then spread with blade graders leaving not to exceed 3 in. in thickness on a width of 20 ft., the remainder being left in a ridge on each side of that width. Blading is then continued and traffic turned onto the road, a small amount of gravel being gradually brought in and moved across the roadway until a crust is formed by the traffic. In this way the surfacing is compacted from the bottom up without at any time having enough material in the travelled way to produce a loose driving condition.

On account of the great variation in gravels found in different parts of the state there is not a uniform specification for cementing values, wearing quality or grading of sizes; the only uniform requirement is that the maximum size of the gravel particles shall not exceed 1 in., which means that in practically all cases screening apparatus must be used, This is usually the ordinary rotary or shaker screen fed by a conveyor, but in the larger gravel hauling projects the material is generally loaded by a dragline or steam shovel through a "grizzly" or grate screen. To prevent oversize being hauled on the road it is required that the shaker or rotary screens have openings not more than 1 in.

in size but when grizzly bars or grates are used it is required that the bars or grates be spaced not more than 3 in. apart.

The state buys or leases the gravel pits, preferably on an average basis but when impossible to secure acreage the gravel is paid for at so much per cubic yard as measured in the trucks delivered on the road. Contracts are let on competitive bidding at a unit price for loading, screening and hauling to the first mile point and a unit price per yard-mile for additional haul beyond the mile point. There is also a unit price bid for shaping and compacting at so much per hour for men and teams but generally this work is turned over to the state maintenance forces. While most gravel hauling is done in the Summer it has been found that a considerable saving can be effected by doing this hauling after the ground is frozen, especially when long hauls are involved, for that enables the contractor to use heavy truck equipment at a greatly reduced price per yard-mile. When such hauling is done in the Summer it is required that pneumatic tire equipment be used in order to protect the subgrade from damage caused by heavy trucks with solid tires.

Stating that 25 per cent of the land in Louisiana was undrained, J. M. Fourney, state highway engineer, indicated the problem which confronted the state in the large mileage of swamp road to be planned and now under construction. Generally the swamp land was wooded and consisted of a top-soil of vegetable character overlying clay at various depths. The top-soil was generally only about 12 per cent solids. Construction consisted in clearing and then removing the top-soil. Then dredges dug a borrow canal parallel to the road fill and built an embankment of the clay subsoil.

Reviews the Coal Commission's General Recommendations

IN SUMMARIZING the recommendations of the United States Coal Commission Edward Eyre Hunt, speaking before the American Academy of Political and Social Science in Philadelphia, brought out the following points:

(1) The commission recommends that the government continue its fact finding and publicity work in both the bituminous and the anthracite coal industry and that the government regulate the industry through the use of its power over interstate commerce. (2) That an administrative agency through which these powers can be exercised be created as a coal division in the Interstate Commerce Commission. (3) Federal licensing of those who buy and ship coal in interstate commerce. (4) A federal tax on royalties and differential profits. (5) The adoption of a uniform standard of either the long or short ton. (6) A re-examination by the Interstate Commerce Commission of the differential railway rates with a view to the promotion of coal movement by water and the discouragement of long haul by rail. (7) A modification of the rules governing distribution of railroad cars in periods of shortage so as to give consideration to the ability of the producer to sell coal rather than to mere ability to produce and load it into cars. (8) That contract coal be given preference over spot coal delivery. (9) That the government as administrator of 50,000,000 acres of coal lands amend the leasing laws so as to restrict the opening of new bituminous mines. (10) That Congress designate an agency to unite with the industry in studies of unemployment and the wage structure, which agency will serve as a medium of publicity for rate information and will be prepared to make special compulsory investigations whenever there is a threat of failure to renew a wage agreement. (11) Continuous publicity as to labor relations with the possible resort to mediation at the instance of the President of the United States. (12) The commission does not recommend nationalization of the mines, compulsory arbitration, compulsory incorporation of the unions, nor price fixing by the government. (13) The commission recommends the consolidation, grouping or pooling of bituminous mining operations, under such restrictions as are prescribed for railroads in the Transportation Act. (14) That state and federal governments co-operate in inspection, revision of mining codes, supervision of compensation insurance, and safety education. (15) That communities license retail coal dealers, organize co-operative associations, open municipal fuel yards or in other ways deal with the problems of local distribution of coal.

The commission recommends to the industry (16) a number of improvements in management methods and the development of efficient mechanical devices to improve the general mining operations. (17) Attention is drawn to the British wage plan which provides that miners and operators share the profits of the business. (18) Better living conditions for the miners. (19) Co-operation with the miners in the study of unemployment and the rate structure, and in setting up boards of conciliation and voluntary arbitration. (20) Improvements in personnel management, training of foremen, and centralized responsibility in labor relations. The commission also recommends the appointment of district and national labor commissions to work out a national labor policy. (21) Collective bargaining to work out a system of national negotiation with district agreement is recommended. (22) The check-off and complete unionization are not recommended.

To the individual coal consumer the commission recommends (23) the buying for regular delivery on contracts and the storing of coal, as well as wider use of technical information regarding methods of fuel economy. (24) Wider use of substitutes for anthracite.

Revaluing Power Properties from Old Records

Under a decision rendered Oct. 27 by Chief Justice McCoy, the District of Columbia Supreme Court is to revalue the properties of the Potomac Electric Power Co., using as a basis the valuation data gathered in 1916-17 by the Public Utilities Commission. The litigation has been before the courts several years, and meanwhile a fund which now exceeds $4,000,000 has accumulated through impounding of the difference between the rate for electric current collected—10 cents—and the rate fixed by the commission, varying from 8 cents to nearly 9 cents. The Public Utilities Commission fixed a valuation on the company's properties for rate-making purposes and announced its decision in 1918, reducing the rates, whereupon the company appealed to the courts, alleging that replacement values had not been allowed by the commission on existing prices, and also that some items had been excluded erroneously. The District Supreme Court denied the injunction; the District Court of Appeals reversed this, and the United States Supreme Court refused jurisdiction last spring, thus allowing the reversal of the Court of Appeals to stand. The company then contended that the entire valuation work must be done over, while the commission contended that the District Supreme Court had the authority to make a revaluation from the old records.

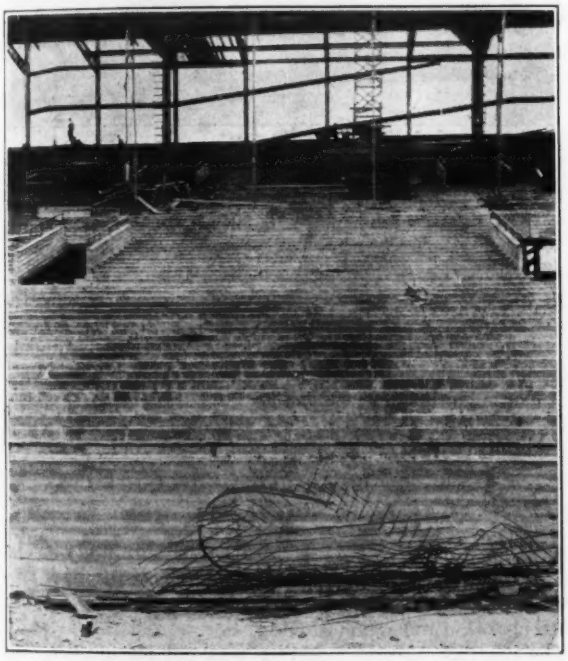
From Job and Office

Hints That Cut Cost and Time For the Contractor and the Engineer

Filtered Sprinkling Water Used To Avoid Iron Stains in Concrete

By G. C. Habermeyer
Engineer, Illinois State Water Survey

CONCRETE placed in the University of Illinois stadium was to be kept wet for 21 days before forms were removed. Water applied to the lower tiers of seats by sprinkling continuously, using a common type of lawn sprinkler, caused an objectionable stain where the water flowed along one course for any considerable time, due to an iron content of 2 p.p.m. in the water. To improve the appearance of the structure a



STADIUM STAINED BY IRON IN SPRINKLING WATER
No stains show between portals where water used was filtered and applied evenly by hand.

pressure filter was installed to remove the iron. The pressure available to wash the filter was not adequate and at times an appreciable amount of iron was left in the water. Further improvement was effected by sprinkling parts of the structure by hand thus securing a more uniform distribution. During the latter part of the work, the seats were covered with sawdust or sand which reduced the amount of water needed.

The view shows stained seats below the portals, which were placed before the filter was installed, and seats between the portals with comparatively little stain which were placed after the filter was installed.

W. A. Slater is in charge of the concrete work for the athletic association of the university and the State Water Survey assisted in plans and installation of apparatus used to reduce the iron stain.

Count of Football Crowds Gives Hints on Stadium Design

By Clyde T. Morris
Professor of Structural Engineering, Ohio State University, Columbus, Ohio

WHILE preparing plans for the stadium at Ohio State University, the writer was impressed with the lack of information as to the number of people which could be accommodated through entrances of various dimensions, on ramps, and on stairways. During the past football season some data have been gathered on this subject at the Ohio stadium which may be of interest.

The design and construction of the stadium was described in *Engineering News-Record*, Oct. 19, 1922, p. 640. The seating capacity is approximately 62,000. There are 39 arch openings on each side of the stadium, provided with iron gates, and turnstiles for taking tickets may be placed at as many of these as necessary. This year 23 turnstiles were used. After the game, all gates are opened, which leaves the sides practically unobstructed for the crowd to pass out.

After the tickets are taken at the turnstiles, the crowd finds its way to the seats by means of 12 portals on each side to the 4 ft. 6-in. level near the bottom of the seat bank through which the lower 32 rows are fed, and six ramps which feed the upper 14 rows of the lower deck and the 22 rows of the upper deck.

At the dedication game, Oct. 21, 1922, there were 70,000 people packed into the stadium, but due to the newness of the structure and the inexperience of both ushers and ticket takers an exact count of the various entrances is not available.

During the season just closed the turnstile counts at the five home games were: Wesleyan, 25,294; Colgate, 27,819; Dennison, 17,247; Iowa, 40,202, and Illinois, 36,877.

The gates were opened at 12:30 p.m. and the games called at 2. The maximum number of people handled through one turnstile was 3,069 and the average of the four next highest was 2,575. A count of persons passed through a single turnstile for 10 successive minutes averaged 46 per minute. There were two men at each turnstile, one taking tickets and the other operating the turnstile. At the student gate, where the tickets had to be torn from books, the best average for 10 successive minutes was 25 per minute.

Observations during the passing of crowds revealed the following facts:

Portals—There is no congestion of people at any point preceding the game except before the turnstiles, and at these the lines are seldom long. Due to this fact no data are available as to the number of people who could enter the seat banks by the various portals and ramps. The crowds always flowed through these freely. The count showed that averages of 20 and 21 persons per minute passed up a flight of eight steps and through a portal 6 ft. wide. At an average pace

of 90 steps per minute and people two steps apart and three abreast, these openings would accommodate 135 persons per minute.

Ramps—The ramps which feed the upper part of the lower deck and the upper deck have short flights of steps at the bottom and top which limit their capacity. The stairs are 9 ft. 3 in. wide and the ramps are 8 ft. 2 in. wide with a slope of about 15 per cent. These ramps accommodate an average of from 50 to 55 persons per minute while the capacity, figured on the same basis as the portals above, and counting five persons abreast, would be 225 persons per minute.

Exits—After the game the exits from the seat banks would be crowded for a period of from three to five minutes. Various exits showed the following actual count of persons passing out: Lower portals, from 100 to 112 persons per minute as compared with the theoretical 133 given above; and ramps 210, 240 and 190 persons per minute during six minutes of count, as compared with the theoretical capacity of 225 given above. The capacity of these ramps is limited by the stairs at the top and bottom.

This Is Not a May-Pole Dance

PICTURED above are Chinese coolies tamping an earthen dike thrown up as part of a flood-protection development carried out to keep the Yellow River, China, under control. Work was done by the Asia Development Co. Your guess as to what the device is made of is as good as ours.

Conveyor on Sewer Job Saves Labor of Four Men

DIVERSITY of use to which elevating equipment may be put is not usually fully understood by many contractors who may rely too greatly upon manual methods where economy would seem to demand installation of machinery for materials handling. A good example of the economy of mechanical means is to be found on a Milwaukee sewerage job, Wenzel & Hennoch being the contractors.

For concreting below ground, two surface plants have been arranged, the conveyor and bin system having been decided upon after two other methods had been tried. A bucket elevator was discarded because it was not fast enough, and the use of a dump car running to the mixed skip from storage piles in the street, used too many men. From a gang of seven by this latter method installation of a belt conveyor reduced the number to three. One man only is required at the conveyor and he is available half the time for other work. At 60 cents an hour per man the monthly saving

From Job and Office

Hints that Cut Cost and Time

in labor by the installation of the conveyor amounts to around $500. It is therefore easy to see that the equipment would soon pay for itself through the economies that it effects. Then when the job is finished the conveyor will have been paid for and can either be used on other work, or turned in for resale with profit to the contractor.

The bin shown in the accompanying view holds 30 cu.yd. of stone and 15 yd. of sand. From this bin the

BELT CONVEYOR USED ON MILWAUKEE SEWER JOB

material is proportioned for a mixer below. The conveyor loads the bins in the morning, being shifted so as to discharge into either the sand or stone compartments. It has unloaded ten large trucks of 4-yd. capacity in 50 minutes. The regular hopper has been built up on each side, the width of the track. A wooden ramp enables the truck to get to the proper dumping height above the hopper.

The information contained in this article was secured from the Barber Greene Co., East Aurora, Ill.

14-Story Reinforced-Concrete Hotel Built in Winter Months

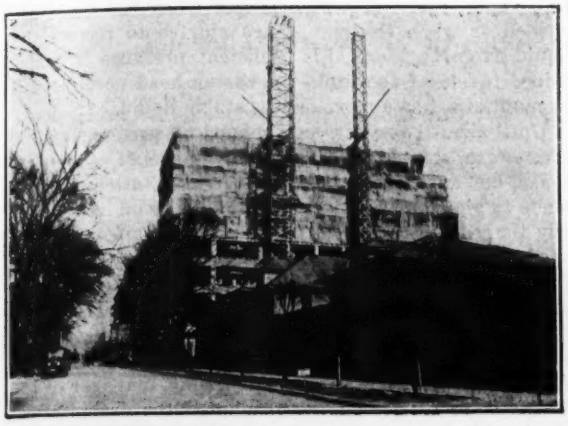
EXTENT to which cold weather concreting may be carried if adequate protective measures are provided is illustrated in the construction of the Keenan Hotel in Minneapolis during the winter of 1922-23. The contract for the building was not let until late in the fall and excavation did not start until Dec. 1, 1922. The ground floor of the building was concreted on Dec. 26, 1922, and the last floor of the 14-story structure on March 2, 1923. This means that all stories were concreted in three months' time—an average of more than a floor per week.

Instead of materials being exposed to cold weather and then heated just before use, they were kept in an inclosed building at the rear of the one under construction. This materials building was kept at the same temperature as that in the portions of the building under construction, or 50 deg. F. As concreting materials were needed, they were conveyed in proper amounts from the storage room and dumped into the mixer, which was placed in a pit below the first floor. Concrete was then hoisted to a level about 20 ft. above the floor being concreted and then chuted into the forms.

Heating was accomplished by salamanders whicl

From Job and Office

For Contractor and Engineer



FIVE FLOORS PROTECTED DURING WINTER CONCRETING OF HOTEL

Canvas was fastened at the top and bottom of each floor so that only one floor had to be uncovered at a time. Thus, protection was offered each floor from four to five weeks before being exposed to the cold weather.

burned coke. One salamander was assigned to 750 sq.ft. of space, or 6,750 cu.ft. From fifty to sixty salamanders were in use during construction.

Owing to the fact that concreting was carried on so rapidly, five floors were covered at a time. The canvas used was of a heavy quality. It was so placed that it could be removed from any one floor independently of the rest of the floors. Inasmuch as five floors were thus offered protection, the newly placed concrete in any given floor was kept under cover for a period of four to five weeks. Since the temperature was maintained at 50 deg. or higher, the concrete had ample opportunity to cure before it was exposed to cold weather.

The record time for concreting one floor was three and one-half days and most of this time was taken up in the building of forms, placing of steel, etc. The actual time for placing the concrete in one floor (approximately 200 cu.yd.) was 7½ hours.

The hotel was built by the Fleisher Construction Co., Builders Exchange, Minneapolis, Minn. Cost of the completed structure was in the neighborhood of $1,000,000.

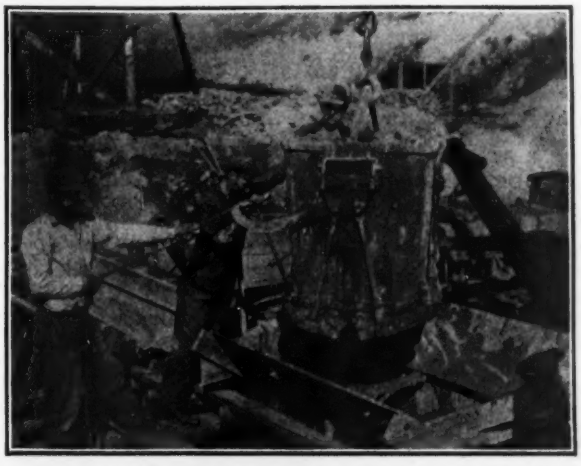
Reinforced-Concrete Piles Fitted With Shoes and Jets

By Harry J. Finebaum
Resident Engineer for Clarence W. Hudson, Hill-to-Hill Bridge, Bethlehem, Pa.

ONE OF the piers of the Hill-to-Hill bridge at Bethlehem, Pa., situated between the tracks of the Lehigh Valley R.R., was founded on reinforced-concrete piles. One hundred piles were successfully driven to rock or refusal, through an overlying bed of sand, gravel and boulders. Twenty-five piles were 25 ft. long while the other 75 were 32 ft. long, these lengths being determined by three reinforced-concrete test piles previously driven. The piles were not all driven their full length, because of the hard driving encountered, but the driving was materially aided by two special features: a cast-iron shoe integrally built with the pile; and an internal jetting pipe with twin outlets also integrally built into the pile.

The shoe is shown in Fig. 1. The part in contact with the concrete was of the same shape and cross-section as the point of the pile, and from there on it tapered down to a 2-in. tip. The areas of the tip of the shoe and the foot of the pile proper thus bore a close relationship to their respective crushing strengths. In order to hold the shoe securely in the concrete of the pile, four holes about 2 in. deep were tapped and threaded in the head of the shoe. Into these holes were screwed four ⅝-in. diameter steel bolts about 2 ft. 6 in. long. After the rods were inserted in the shoe, they were bent so that they all crossed each other as shown.

Pouring Concrete from Dump Buckets



DEFORMATION of formwork is liable to result if care is not exercised in dumping concrete when it is placed by dump buckets. To obviate form distortion J. D. Miller, carpenter foreman on Anderson & Bros.' contract at the Tipton dam, Pennsylvania, devised the method herein illustrated of controlling flow of concrete from bottom-dump buckets. The device is merely a light rope with a hook fastened on one end. The hook is placed over the top edge of the bucket and the rope is passed under the bucket and two turns of it are taken around the bail. The doors can then be held to the desired opening.

The whole thing was set at the end of the pile form thus acting as an end form when the pile was cast.

The jetting pipe is shown in Fig. 2. It consisted of three parts: the twin outlet, the tube and the elbow-nipple inlet. To cheapen the cost of these pipes, the twin outlet and the tube were made of light-gage galvanized sheet metal with soldered longitudinal and transverse joints, while the inlet was made up of standard 1½-in. iron pipe fittings.

The jetting pipe was held in the center of the form by wiring it to the radial ties of the reinforcing system in the piles.

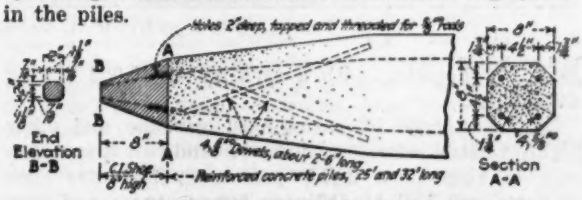


FIG. 1—DETAILS OF SHOE FOR CONCRETE PILE

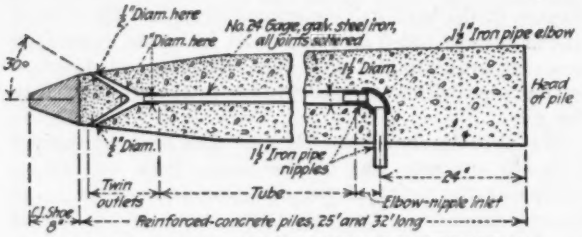


FIG. 2—JET PIPE AIDS IN PILE PENETRATION

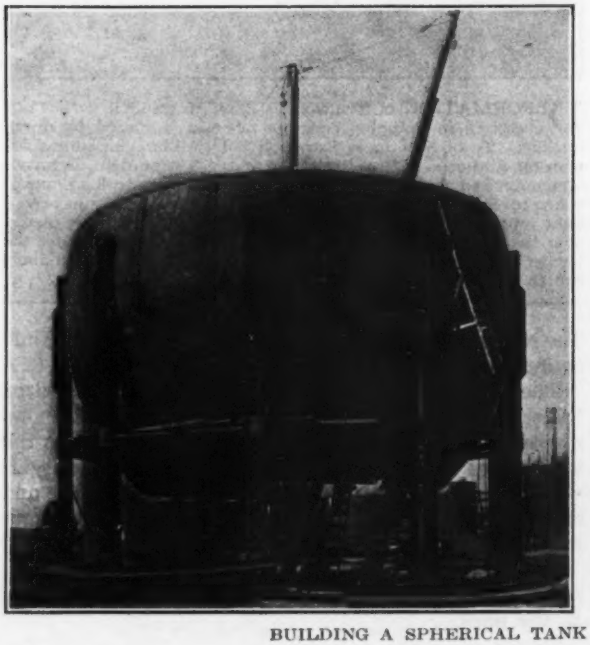
The two ends of the twin outlet were reduced to ½-in. diameter so as to produce a high nozzle pressure, and were located immediately above the head of the pile. These ends were cut to be parallel to the sides of the pile form.

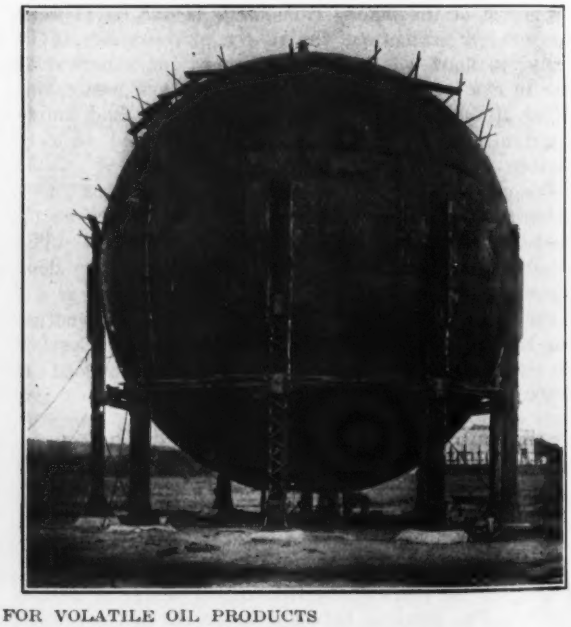
When they did not snugly fit against the sides of the form small wooden plugs, ¾ in. square, were inserted between them and the form so as to form a seal against the entering of mortar into the pipe. These plugs were removed after the forms were stripped from the concrete piles.

Before driving the piles, a steam hose was attached to the nipple of the jet inlet and live steam forced through the jetting pipe, to insure a clear passage.

Spherical Steel Tank Is Novel Structure

SPHERICAL tanks represent a new development in tank design in order to meet the requirements for storing oil products of high volatility. The first of several such tanks, designed and built for the Texas Co. at Tulsa, Okla., by the Chicago Bridge & Iron Works, is shown in the accompanying views. It is





BUILDING A SPHERICAL TANK FOR VOLATILE OIL PRODUCTS

48 ft. in diameter, with a capacity of 10,000 bbl. or 420,000 gal.

In the storage of casing-head gasoline and other highly volatile refined products of crude oil it is necessary to keep them under pressure. Otherwise such products will boil at ordinary temperatures and pass into vapor, much of which is lost when the tanks are opened or when the pumps are started to remove the liquid from the tank. If sufficient pressure is maintained inside of the tank, the casing-head gasoline will be maintained as a more or less stable liquid.

Until about two years ago refined oil products of this kind were stored under pressure in small cylindrical tanks, but as the manufacture increased, attempts were made to store them in larger tanks. The oil men naturally turned to the flat-bottomed storage tank commonly used for the storage of oil and ordinary gasoline, but found that this type did not lend itself to pressure storage. It was evident that the expense of building foundations and anchoring a flat-bottomed tank thereto would practically prohibit the use of this type of tank. As a first step, therefore, H. B. Murphy, manager of the Dallas office of the builders, adapted the design of an elliptical-bottom elevated steel tank to withstand pressure by adding a roof with the same shape as the bottom and designing it for a working pressure of 15 to 20 lb. per square inch. The first tank of this nature, of 10,000 bbl. capacity, was built for the Phillips Petroleum Co. at Bartlesville, Okla. While it was found successful in operation there was doubt as to whether the design was the most economical.

That a spherical tank would make a better design to meet the conditions was suggested by George T. Horton, president of the Chicago Bridge & Iron Works, and the original design was changed to fit this idea. The "hortonsphere," as this spherical tank has been named, is said to have proved a complete success. As far as the detailing of the "hortonsphere" is concerned, it is very similar to the standard practice developed by the company in the construction of elevated steel tanks.

From Job and Office

Hints that Cut Cost and Time

From Job and Office

For Contractor and Engineer

Job and Office Notes

In Connection With an Abstract of the Report on "Renewing Railroad Culverts" heard at the recent convention of the American Bridge and Building Association, and printed in these columns recently, Leonard M. Sandston, consulting engineer of Middletown, Ohio, and associated with the Armco Culvert & Flume Manufacturers Association recalls renewals which have been made by the use of corrugated culvert pipe. "P. F. Jones, reported in *Engineering News-Record*, Aug. 24, 1922, p. 321," writes Mr. Sandston, "how he solved the problem of carrying the south branch of the Davis-O'Connor drain under the main line of the Southern Pacific R.R., and underneath a paved highway without any interruption to traffic by using an Armco corrugated culvert pipe as a tunnel shield to bore through the embankment, with an ordinary screwjack supplying the motive power. The pipe, although unprotected on the driving end, was quite uninjured at the end of the job. Other instances of this kind have been reported from time to time, as follows: R. V. Merkle, engineer to the Turlock Irrigation District, Stanislaus County, Calif., successfully jacked a 36-in. diameter corrugated culvert pipe through a fill of stones and hardpan, under a concrete paved road without any damage either to road or pipe. At Ingalton, Ill., in 1911, 120 ft. of 48-in. diameter corrugated culvert pipe was jacked under the main tracks of the Chicago Great Western R.R. through a fill 35 ft. high. Where it is at all possible to use this method, especially on railroad work, it would appear to have a distinct advantage in that no interruption of traffic is entailed."

When the Compania Hidroelectrica a Irrigadora del Chapala. S. A., of Guadalajara, Mexico, installed their new Las Juntas power house they were confronted with a difficult problem in getting heavy equipment to the site of the power house. There was no railroad reaching the site of this plant and, moreover, a typical Mexican mountain intervened between the nearest railroad and the power site. The solution of this problem was the installation of a wire rope incline 4,370 ft. in length. The total difference in elevation between top and bottom of this incline is 1,722 ft., and the greatest degree of inclination is 39 degrees. It is equipped with a Lidgerwood hoist having a 105-hp. G. E. motor. The car is lowered by a 1¼-in. patent flattened strand Hercules (red-strand) haulage wire rope. Loads weighing up to 15 tons are handled. This incline was installed in about the middle of 1922 and is still in use. Eight round trips is the average daily mileage of the car.

Building a Reinforced-Concrete Structure without formwork may sound like a peculiar process, but it has been done by a farmer in the construction of a small storage cellar, says a recent issue of the house organ published by the Alpha Portland Cement Co. The spot designated as the location for the cellar was marked on the ground by means of chalk lines accurately squared. The area so marked represented the lines formed by the inner wall and was 8 ft. wide and 12 ft. long. The center of the space was crowned with clay, the center being raised about 12 in. or more from the side. After this crown had been placed it was tamped thoroughly with a wooden mallet and finally smoothed off. Trenches were then dug for the four walls. Care was taken during the digging to see that the inner wall of earth was kept as near true and unblemished as possible. The trench was made wide enough at the top for the digger to work in easily. Walls were 8 ft. high. Before any concrete was poured a door frame 3 ft. 4 in. was made of 8-in. boards and braced. This was then set against one end of the cube of earth, centered and made secure. Concrete was then dumped in about the bottom of the trench until about a foot high whereupon 1-in. boards were placed on the outside of the concrete and earth shoveled on the outside of the board. As soon as the concrete reached the top of the board, the board was raised and loose earth fell against the wet concrete wall, keeping it from spreading. In this way the four walls were built up. Reinforcing was used in short lengths at the corners. When all the concrete was in and had properly set the interior of the cellar was excavated. Hand shoveling and a team with a slip scraper accomplished the excavation. Interiors of walls were found to be almost as smooth as though wooden forms had been used. This method is prescribed as being satisfactory only in walls of unusual compactness—in other words, either heavy clay or soils.

In Connection With the Installation of a new pumping outfit at Tully, New York, recently, it was found necessary to cut a section about 8 by 12 in. through the side of a steel basin ¼ in. thick in order to admit the suction pipes, writes Louis Mitchell, dean of the L. C. Smith College of Applied Science, of Syracuse University. The top of the steel casing was flush with the ground so a trench was opened about 6 ft. deep at the point where the pipes were to enter. In order to obviate delay in cutting the opening with a drill or torch (the latter not being available in the village), the plant attendant who is an expert rifleman brought out his rifle and shot holes around the section to be removed. These holes were made from ½ to ¾ in. apart and the section was then chiseled out, taking only a couple of hours to complete the work. A No. 303 "Featherweight" Savage rifle was used with soft nose bullets. The attendant stood about 20 ft. away from the tank and as the trench was darkened by the building over the basin, a lantern was set by the side to light the section exposed. The shots were fired at an angle so that after piercing the steel shell they entered the water and did not damage the other side of the tank.

An Application of the Welding Process which illustrates the value of oxy-acetylene welding in the fabrication of steel structures as well as the possibilities offered for reclaiming used material has recently been demonstrated by a midwestern concern which has designed and built a well drilling driver constructed of reclaimed pipe and fabricated by welding and cutting. This driver has been used to drill a number of artesian wells, and has very satisfactorily stood up under the severe usage to which it has been subjected—according to the Linde Air Products Co. The drilling driver is built of 2-in. pipe and other material reclaimed from the scrap pile. It consists of two uprights 25 ft. high with a cross-bar 5 ft. long, all of 2-in. pipe; these forming a rectangular structure open at the bottom. The crossbar is joined to the uprights at the two corners by welding. The uprights rest upon two base plates 12 in. square and ¾ in. thick, and are welded to these plates. The frame is braced by welding two pieces of 2-in. pipe from the crossbar to the two uprights. Eye-bolts are welded to the top and about the middle of the frame on each side and guy wires are attached to these. When the driller is in use the guy wires run from these eye-bolts to iron stakes 15 in. long and 1 in. in diameter which are driven into the ground. A collar welded to each of these stakes prevents the guy wire from slipping off. The hammer is made of a section of 14-in. pipe to the bottom of which a round piece of 1-in. plate has been welded. The hammer is weighted to give it a total weight of about 150 lb. and a piece of ¾-in. plate is welded to the top. An eye-bolt is attached to the center of the top plate by welding, this being the point of connection for the cable by which the hammer is raised. The cable runs through a pulley which hangs from an eye-bolt welded to the top cross member and from this pulley the cable runs to the cable winding drum. Extending laterally from the hammer and welded to it are two arms. These are in turn welded to sleeves which slide up and down on the uprights and serve as guides for the hammer.

Letters to the Editor

This department aims to be a forum for the discussion of the views of engineers and contractors. The range of interest should be as wide as possible. Contributors are, therefore, asked to make their letters short.

Help for a Federal Contract Law

Sir—I read with interest the editorials in *Engineering News-Record*, Nov. 1, pp. 203 and 205, one entitled "Function of Contracting" and the other, "For a Federal Contract Law." Both the subjects covered by these well-considered articles are pending before the Inter-Departmental Board of Contracts and Adjustments of the United States.

In the latter article, the sentence which especially attracted my attention was: "If the board follows its procedure in drafting the standard contract form to invite aid in arriving at decisions from the whole construction industry, engineers and contractors can play a useful part in formulating the general federal contract law. There are few employers of which they have more loudly complained in the past. Let them be as ready to help put away the causes of complaint."

The last sentence is good advice and I believe far more important than even you realize. I hope that you can see your way clear to make this exhortation stronger and clearer, and to accomplish this you may have to emphasize it by repetition. When I organized this board, I realized that contracts had to be fair and equitable to both parties. It was true that in the past high-class contractors and men who sold supplies to the government had in many cases just cause for complaint against the contractual procedure of the United States Government, including its form of contracts. In performing the task assigned of simplifying and standardizing as far as possible contract procedure and contract forms, I knew our work would not be of benefit unless we considered both parties to the contract. Not knowing or being able to know the other man's viewpoint without consulting him before the contract was drafted, I adopted the policy of inviting suggestions and constructive criticism of contractors, engineers, architects and others who might be directly or indirectly interested in government contracts. (All taxpayers are indirectly interested in this subject as in the long run they have to pay the cost.) Accordingly, I sent out several hundred copies of a tentative form of contract, accompanied by a questionnaire, and I can assure you that our board has carefully considered every constructive criticism which it has received. Some changes we would like to make are prevented by federal statutes which have been passed from time to time, not by the contracting officers of the United States Government, but by the congress elected by our citizens. Many of these statutes are unduly restrictive in the interest of the government against the contractor, and there are other objections well set out in your articles.

The subject of the new federal contract law, while important, is not a sensational subject to attract attention or throw the spotlight on any politician who might wish to advocate it or oppose it. Therefore, it is most important that thoughtful people, organizations and publications should continue the advocacy for such a law and show their congressmen and senators the necessity for the enactment of a non-political, non-partisan bill in the interest of the government and its citizens, whether they contract with it directly or not. I can assure you that the principle of consulting the other party in advance is being followed in relation to the new federal contract law, as I have written many letters asking for suggestions regarding this law, and I will appreciate any suggestions I can get from you as to how this matter can be brought forcibly before the largest number of your readers.

I also hope that you can further assist by having other suggestions sent in regarding the new standard form of contract which is now being considered by the board. Again quoting you, "Let them be as ready to help to put away the cause of the complaint" by taking a little time to send in some constructive criticism.

GORDON A. RAMSEY,
Chairman, Inter-Departmental Board of Contracts and Adjustments of the United States.

Chicago, Ill., Nov. 14, 1923.

Aluminum Paints Reduce Radiation

Sir—Reference is made to the article in *Engineering News-Record*, Sept. 27, 1923, p. 522, entitled "Radiation Reduced by Aluminum Paints." While the radiation from a surface bronze painted is greatly reduced, the transmission of heat by convection is not correspondingly reduced. In total, an aluminum or "gold" bronze coated radiator will give off about 76 to 83 per cent as much heat as an unpainted radiator of the same size and shape, with other conditions equal (*cf.*, Bureau of Standards *Technical News Bulletin* No. 77 of Sept. 15, 1923, Art. 18). Radiators coated with ordinary oil paints and enamels give off from 97 to 103 per cent as much heat as an uncoated radiator.

New York, N. Y., Oct. 26, 1923.

G. S. BURRELL,
Commander, (CEC), U. S. N.

Vibration in Water Wheels

Sir—It is possible that another contributing cause to the troublesome vibrations in the runners of hydraulic turbines, mentioned on p. 764 of your issue of Nov. 8, 1923, is that the frequency of the fundamental note of the individual vanes of the runner agrees with or is a simple multiple of the frequency of the pressure changes. A number of years ago I found that this was the case with the rotor of a steam turbine, the plucked tone of a single (small) blade having a frequency almost identical with that given by the r.p.m. of the rotor. The substitution of thicker blades, having a lower fundamental, did away with the steady breaking of blades that had nearly prevented the sale of the product.

In the case of the runner that produced the record given in Fig. 3, p. 764, there were about 150 vibrations per second, or a vibration each time a runner vane, at 450 r.p.m., passed each one of the twenty guide vanes. The fundamental note would be not far from D in the bass clef, not unreasonable for a piece of metal of the size indicated. The cutting away of the strips on the edges of the vanes would not only muffle the pressure changes and decrease the efficiency by increasing the thickness of the water ring, but the change would also increase the frequency of the fundamental note of the runner vane and so prevent it from synchronizing with the pressure changes.

H. S. S. SMITH,
Emeritus Professor of Civil Engineering, Princeton University.

Stroudsburg, Pa., Nov. 14, 1923

Publicity for Proposed Laws

Sir—Regarding your editorial in the Nov. 15 issue of *Engineering News-Record*, p. 788, entitled "Power and the People," which referred to our recent election and the proposed constitutional amendment covering water power development on state lands in the Adirondacks, you do not mention the cause, which, in my opinion, had more to do with the defeat of this measure than any other. That is the practice of the majority of the voters in voting No on general principles on all propositions which they do not understand. I know that was the case in this city, where the people do not take a great deal of interest in the public parks in the Adirondacks. Questions like this are decided largely according to whether the proponents or opponents put forth the better grade of propaganda. There was so little agitation on this question previous to election that it is not surprising the amendment was lost.

Let those who are materially interested in having such an amendment pass do a little advertising and educate the voters regarding the wisdom of passing the measure, and possibly it will have better success next time.

Jamestown, N. Y., Nov. 17, 1923.

WALTER F. SHAW,
Consulting Engineer.

News of the Week

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

News Brevities

All Missouri Road Construction Records for the State Highway Commission were broken during November when $1,907,461.94 was actually paid to contractors for completed work.

Voters of Aberdeen, Wash., on Dec. 1 passed Wynooche power project bill involving the expenditure of $2,000,000 to provide additional water supply and hydro-electric power for the city. The mayor and city council are pledged to secure complete cost data before proceeding with actual work.

At the Annual Convention of the American Society of Mechanical Engineers held in New York City last week, John R. Freeman, past-president of the American Society of Civil Engineers, was awarded the A. S. M. E. medal. The award was made for his service to industry through his activities in fire prevention.

The Temple Bill, Providing for the completion of mapping the United States in twenty-five years, will have the endorsement of Secretary of War Weeks and Secretary of Interior Work, assurances to that effect having been given recently by these officials to L. W. Wallace, executive secretary of the Federated American Engineering Societies, who explained the need of this legislation to the two secretaries.

City Planning and Zoning at Nashville, Tenn., has been made the subject of study of the Engineering Association of Nashville, which recently submitted a brief report on the subject to the city authorities. The local situation was reviewed and a number of recommendations made. A paragraph in the report of broad general interest is one advocating that the association assist "the city engineer in bringing the public and the city government to a due appreciation of adequate municipal engineering practice and work." A. F. Ganier is chairman of the committee named.

To President Coolidge Has Been Addressed a letter by Dean Hugh Miller of George Washington University protesting against the removal by Secretary of Interior Work of A. P. Davis, former director of the U. S. Reclamation Service and an alumnus of the Corcoran Scientific School, predecessor of the George Washington University Engineering School, the protest being made "because Dr. Work's action is so detrimental to the technical work of all departments of the government." The letter requests the President to take official cognizance of the matter and to have a thorough examination made of all the events leading up to this action of the Secretary of the Interior.

State Highway Officials Hold Annual Convention

Constitution Revised—Organization Plan Laid Before Members—Department Turnover and Legislation Leading Topics

Engineering News-Record Staff Report

With representation from all but two states among the 200-odd state officials present, the American Association of State Highway Officials carried through an extensive program of technical discussions and committee work in the four-day meeting at New Orleans, La., Dec. 3-6. Development of committee work was the prominent feature of the meeting. With the exception of the annual message of Thomas H. MacDonald, chief of the Bureau of Public Roads, one full day was devoted to sessions of the 12 committees and sub-committees, and a large part of two sessions was occupied in considering the reports of these committees. It was clearly indicated that, as the committees developed their plans and as research studies now well begun are completed, the technical activities in annual convention will consist largely in the reading and discussion of committee reports.

Constitution Revised

Three classes of members, active, associate and honorary, with dues of $10 for active and $6 for associate members, or dues of $200 for an entire state department, were agreed upon. Only active members can vote and they must be chief directing officials of state road departments. The associate member classification provides for subordinate officials. Honorary membership provides a place for "former state and territorial highway officials and the professors of highway engineering in accredited universities," and for others who "shall be proposed by a member and elected by the executive committee." It is provided further that in case the president, who must be an active member, shall retire from official connection with state highway administration or shall leave the office vacant by other reason, the vice-president shall act as president in the interim between annual elections.

In the new organization, a president and executive committee act through bureaus of administration, special assignments, general office, publications and standards and through such committees and sub-committees as may be necessary.

Committee Work

Few of the committees have proceeded far enough to do much more than report progress. Publication will soon be made of the report on methods of conducting tests and of standards for metal bridges and culverts. The association journal, *American Highways*, is being issued quarterly. At present the committee funds are too limited to permit of any extension of its publication work. Recent organization of a committee on administration has permitted it to get no further than to adopt a plan of operations. A definite report at the next annual meeting was forecast.

The most active progress has been made by the committee on standards working through its sub-committees on plans and surveys, on design, on specifications, on traffic control, and on bridges and structures. No changes in the Bureau of Public Roads standards for making surveys and plans were considered now necessary by the com-

Federal Budgetary Provisions for Engineering Services

Washington Correspondence

In line with the desire of the administration to cut federal expenses so that there can be a substantial decrease in the national debt in the coming fiscal year engineering services have been given few increased appropriations in the report of Director of the Budget.

The budget which just has been submitted to Congress provides $130,000 to enable the Bureau of Standards to co-operate with government departments, engineers and manufacturers in the establishment of standards, methods of testing and inspection of instruments, equipment, tools, and electrical and mechanical devices used in the industries and by the government. This includes the practical specification for quality and performance of such devices and the formulation of methods of inspection, laboratory and service tests. This will permit of some expansion of this work. The amount appropriated for the current fiscal year was $100,000.

For the investigation of standards of practice and methods of measurements of public utilities, such as gas, electric light, electric power, water, telephone, central station heating, and electric railway service, the budget carries $105,000. This is an increase of $10,000.

For technical investigations in co-operation with industries upon fundamental problems involved in industrial development, with a view to assisting in the permanent establishment of new American industries, the budget carries $180,000. This is $30,000 more than was made available for use during the current fiscal year.

Britain Given Turbine Contract

The Newfoundland Power & Pulp Co. has awarded the contract for the seven Francis type turbines of 14,000 hp. each, or 98,000 hp. total, to Armstrong-Whitworth & Co., Ltd., England. The company is building on the Humber River in Newfoundland.

mittee on plans and surveys. Announcement of progress was made by the committee on transport. The committee on specifications called attention to the standards for contract and bidding forms reported last year and urged their greater use and recommended substitution where desired of negotiable securities for guaranteed bonds.

Design and construction received more definite consideration than any of the other committee subjects. The committee on relations with contractors reported only moderate progress in advance of the general principles laid down last year. Special effort was made by the contractors' unit of the joint committee to obtain definite action for bonding reform but action was limited to decision to hold a further meeting, with the bonding companies represented, to seek an agreement on policy practice.

The committee on design recommended the limiting of vehicle loads to 800 lb. per inch-width of tire and to 19,000 lb. on one axle. It limited vehicle length including trailer to 65 ft., overall width to 9 ft., height to top of load 12½ ft., minimum axle spacing 5 ft. and wheel gage to 54 in. The maximum rim of solid tires was limited to a thickness of 1½ in. Subgrade testing was recommended and also the use of a sand layer in unstable soils. The usefulness of tile drainage was considered to be undetermined. In slab design the formulas reported by the Illinois Bureau of Highways for edge thickness, $T = \sqrt{\frac{3W}{S}}$, and for center thickness, $t = \frac{7T}{10}$, were recommended. The report favored modulus of rupture tests instead of crushing tests and longitudinal tongue-and-groove joints with dowels.

Following the extensive report last year in construction organization and management the committee on construction advocated these practices in detail: (1) Separate contracts as grades, surfacing, structures; (2) developing the use of local materials; (3) payment of materials in stockpiles; (4) fills to stand one year before surfacing; (5) use of 1-in. maximum size gravel without rolling; (6) longitudinal joints in concrete paving; (7) care to avoid segregation in stockpiles; (8) proportioning concrete by weight; and (9) the use of calcium chloride for curing.

Business Action

Perhaps the most important business action was the discussion to promote actively in the present Congress a federal aid program calling for an appropriation of $100,000,000 yearly from July 1, 1925 for three years, and in addition $10,000,000 for forest roads, 70 per cent of which should go to routes forming links in the federal-aid system. In his report the executive secretary called for active aid in advancing this program before Congress. In reporting a practice in financing road work the executive secretary gave the following figures of the sources of income in percentages:

Source	Construction	Maintenance
Tax levies	51.8	15.9
Auto licenses	35.8	55.7
Gas taxes	9.5	16.4
Other sources	2.9	2.0

Officers for the ensuing year were elected as follows: President, F. R. White, chief engineer, Iowa Highway Commission; vice-president, F. F. Rogers, state highway commissioner, Lansing, Mich.; secretary, C. M. Upham, state highway engineer, Raleigh, N. C.; and treasurer, F. T. Sheets, superintendent of highways, Springfield, Ill.

Sir William MacKenzie Succumbs

Sir William MacKenzie, Canadian railroad financier and builder, died in Toronto on Dec. 5 after a long illness.

He was born in Kirkfield, Ont., Oct. 30, 1849, was educated in the public schools and later attended the military school at Toronto. He taught school for a short time after leaving that institution and then went into business. When the Toronto and Nipissing line of the Grand Trunk was being built he went into railway contracting.

In 1886 he met Donald Mann and went into partnership with him, a partnership which resulted in the construction of the Canadian Northern Ry. as a transcontinental line, a work that brought knighthood to both men. Sir William MacKenzie served as president of the Canadian Northern Ontario Ry., and of both the Winnipeg and Toronto street railways and numerous other smaller public utilities.

A fuller biography of Sir William MacKenzie will be given next week.

Lord Shaughnessy Dies

Thomas George Shaughnessy, more familiarly known as Sir Thomas Shaughnessy, and recently as Lord Shaughnessy, chairman of the board of directors of the Canadian Pacific Ry., died suddenly of heart trouble at Montreal on Dec. 10, aged 70 years.

Lord Shaughnessy was born in Milwaukee, Wis., on Oct. 6, 1853. He attended the public schools of that city and when 16 years old entered the employ of the Chicago, Milwaukee and St. Paul Ry. In 1882 he went to Canada with Sir William Van Horne as general purchasing agent for the recently organized Canadian Pacific Ry. He continued in the service of that railway company during the remainder of his life, becoming assistant to the president in 1889, a vice-president and director in 1891, and president in 1899, retiring to become chairman of the board of directors in 1918. It was largely through his efforts that the Canadian Pacific became the great rail and water transportation system that it is today. His services to his adopted country were recognized by knighthood in 1901, by the rank of commander of the Victorian Order in 1907, and in 1916, for his distinguished services to the empire in the war he was elevated to the peerage.

Drainage Congress at St. Louis

The National Drainage Congress has selected St. Louis for the annual meeting, to be held Jan. 16 and 17. The Levee and Drainage Contractors Association will hold its meeting at the same time and place. C. S. Gannon, St. Louis, is secretary of both organizations.

Harbors Congress Debates Chicago Water Diversion

Strong Argument Counters Opponents' Claim of Navigation Damage, Treaty Contravention, Etc.

Engineering News-Record Staff Report

A debate on the diversion of Great Lakes water through the Chicago drainage canal into the Mississippi River was a leading feature of the nineteenth National Rivers and Harbors Congress, held at Washington, Dec. 5-6. W. G. Bruce, of Milwaukee, and C. A. Maguire, mayor of Toronto, Ont., attacked the diversion, while G. S. Williams, Ann Arbor, and R. I. Randolph, Chicago, defended it. No decision was rendered.

Mr. Bruce raised the question whether one region shall be permitted to injure another and persistently defy the law and violate government orders. He stated that Great Lakes shipping suffers a yearly loss of $750,000 per inch of decrease of navigation depth, or for the 6-in. decrease caused by the Chicago diversion a total of $4,500,000 per year. He questioned whether compensating works such as have been proposed by the Chicago Sanitary District would effectively compensate, and held it doubtful whether Illinois could legally spend money on works in other states.

Mr. Maguire stressed the international phase of the question and criticised sharply the Chicago claim that it cannot dispose of its drainage without polluting waters that are a common possession. He asserted that Chicago is the only large city that continues to dispose of its sewage in raw state and he pointed as an example to the requirement placed upon Toronto by the government authorities of Canada that it purify its sewage and refrain from discharging it raw into Lake Ontario.

Proponents of Diversion

Gardner S. Williams denied categorically and in detail that the Sanitary District diversion of 10,000 sec.-ft. is contrary to law or to federal authority, that the primary purpose of the diversion is power development, that the diversion contravenes the 1909 treaty with Great Britain, and that the diversion damages navigation. Mr. Randolph reviewed a considerable number of arguments presented against the Chicago diversion. He showed that Chicago is now spending great sums of money for sewage purification, this, however, applying only to the sewage flow exceeding the diluting capacity of the 10,000-sec.ft. drainage canal flow. He countered the charge that the lower rivers are polluted, by referring to the dismissal of the St. Louis suit and to the fact that all the river cities discharge raw sewage into the rivers. He answered the charge of navigation damage on the Great Lakes by describing the lake-level fluctuations due to other causes, and claimed that the magnitude of these fluctuations robbed the lowering due to the Chicago diversion of all real effects.

He also denied with detail argument the charge of violation of law and violation of treaty obligations, and stated on the question of violation of law that the case is still in court. He asserted that Canada is now drawing a large amount of water in excess of its treaty allowance, and charged that the violation is so flagrant as to lead the International Joint Commission to appoint commissioners to determine the amount.

Founder Societies Discuss Power Development

Mechanical Engineers, Closing Annual Convention, Meet with Civil and Electrical Societies

Engineering News-Record Staff Report

As a part of the program at its annual meeting the American Society of Mechanical Engineers held a joint meeting with the civil and electrical engineering societies to discuss the development of hydro-electric power. The meeting was held in the Engineering Societies Building, New York, Dec. 5 with Lewis B. Stillwell, past president of the A.I.E.E., presiding.

John R. Freeman, a consulting hydraulic engineer, and past president of both the civil and mechanical societies, opening the meeting with a paper on the principles underlying hydro-electric development, reviewed the improvements in the use of water power during the past fifty years and sketched some difficulties which have made many projects either poor paying or failures. Mr. Freeman foresees possible extensive changes in long-distance power transmission, making possible the economic development of isolated power sites, but he also feels that such improvements may have their present advantage largely offset by improvements in heat engines. Dissipation of the "propaganda and fog" which now surrounds the question of hydro-electric development and education of the public to understand that much of our power which now is "running to waste" cannot be developed, transmitted and distributed in our great centers of population at a cost necessary to compete with steam power, he believes. He takes the case of the St. Lawrence as typical, enumerating how some engineers claim that this power can be developed and sold in competition with steam power at great population centers, while other engineers are equally positive that it cannot be developed. In conclusion, Mr. Freeman said that our fundamental problem in the development of these resources is to determine how soon we need it, what it will cost, how much we can pay for it, and how much is needed.

Other Speakers

John P. Hogan, a member of the civil engineering society and a consulting engineer on hydro-electric developments, gave an exposition of the pitfalls which face unwary designers of hydro-electric projects, summing up causes of such failure in the phrase "over-estimation of the amount of water and under-estimation of the cost." He stressed the fact that over-estimates of flow are due to our short-duration runoff records, none of which is long enough to give a true value for the minimum flow. Under-estimates of cost are due to the lack of complete preliminary studies of the power site, its accessibility, its surface features, and particularly its subsurface conditions.

Col. Hogan was followed by George A. Orrok, a member of both the mechanical and civil societies and a consulting engineer for the New York Edison Co. In his paper on water power costs vs. steam power costs, Mr. Orrok pointed out that the present low cost of coal, particularly in the great coast cities, and the high cost of transmitting hydro-electric power to those cities, gives steam power the advantage. According to his figures, hydro-electric power will not be able to compete successfully with steam power until the price of coal reaches $10 or $12 a ton.

The last paper of the evening was presented by Harold W. Buck, of the electrical engineers, on the interconnection of power systems. Its value lay in its clear statement that the major problem lies in the proper correlation of the two sources of power so that full advantage can be had of both systems of water and steam power. With diagrams Mr. Buck showed how, by the use of small blocks of steam power, the continuous output of a hydro-electric plant on a steam of variable flow could be largely increased. He mentioned the Cohoes plant on the Mohawk River as a typical example, wherein a steam reserve of 10 per cent made it possible to double the installation of hydraulic machinery. He does not think that a superpower system will reduce the general cost of power, but he does think that it will benefit manufacturing plants in isolated localities and will make it possible to develop water-power sites otherwise valueless.

The meeting was closed by some brief discussions and a general summing up by the chairman, in which he emphasized the necessity of standardizing the frequencies of our water and steam power plants so that a superpower system can be built up without excessive cost for changing machinery.

Subway to Replace Elevated Ry.

A proposition to replace the 6th Ave. Elevated Ry. in New York with a 4-track subway has been put forward by a large number of property owners along the avenue. The plan calls for five miles of subway to be paid for by a property assessment.

Reclamation Advisers Hear News-Record Editor

In his weekly news statement on the work of the Committee of Special Advisers on Reclamation, Governor Campbell, chairman, last week announced that the committee had taken testimony of F. E. Schmitt, associate editor of *Engineering News-Record*, concerning facts and views gathered on a two months' trip over a number of reclamation projects during September and October. Governor Campbell stated that Mr. Schmitt had contributed a large amount of valuable information and had apparently come to the conclusion that reclamation as a general policy is sound; that it would have rather violent ups and downs, but that it should be continued. Former Secretary Garfield expressed the opinion that much good would be done by the articles on reclamation published in *Engineering News-Record* in drawing greater attention to the problems of reclamation on the part of engineers.

Senator Gooding, who appeared before the commission during the week, laid chief blame for the troubles of the reclamation farmers at the door of the railroads. He advocated a five-year moratorium, reclassification of land and repayment on a forty-year plan.

Governor Campbell announced that the commission is gathering full information in regard to freight rates and other transportation matters.

D.-O. Process Permitted for Austin, Minn.

However, State Board of Health Classes Plant as Chemical Treatment and Explains Position

Faced on the one hand with the conclusion that the electrolytic element of the direct oxidation process of sewage treatment adds materially to lime treatment alone except through the mixing of the paddles used in the electrolizers and on the other by the opinion of the Attorney General that lack of proof of the efficiency of any portion of a proposed sewage-work is not sufficient to warrant disapproval of plans for the whole plant unless the questioned element is considered to be detrimental to the satisfactory working of the plans, the Minnesota State Board of Health has approved plans for the treatment of the sewage at Austin, Minn., by the direct-oxidation process, but as a chemical precipitation plant only, and with the distinct understanding that the "electrolizers cannot be considered as more than devices for additional mixing of the lime with the sewage until it can be demonstrated to the satisfaction of this board that the electrolytic portion of the process is of material value in the treatment of sewage."

The plans in question, at least in general outline, were submitted to the State Board of Health on Aug. 16. They included screens followed by lime treatment and the passage of the sewage through electrolizers into settling tanks equipped with Dorr thickeners, the tank effluent to be discharged into the Cedar River. The sludge is to be pumped to a rotating filter then passed to a dryer. At a meeting of the board held on Nov. 6 a report was submitted to the board and action taken along the general line already stated, with the proviso that detailed plans and specifications should be submitted to the board in duplicate. On Nov. 16 the plans were submitted and approved.

Chemical Precipitation Reviewed

The lengthy resolution adopted by the board on Nov. 6 includes in its preamble a review of the general status of chemical precipitation, in which it is pointed out that, aside from the very few direct-oxidation installations in use, the cities of Providence, R. I., and Worcester, Mass., are the only ones in this country where chemical precipitation is now in use, and that works which will permit the abandonment of chemical precipitation at Worcester are now being built. The preamble also expresses the opinion that while chemical precipitation in itself is satisfactory and produces an effluent that will be satisfactory, with ample dilution, so long as the "causticity due to the excess lime" continues, yet there is always the possibility of offensive decomposition when certain conditions arise. Should this happen at Austin it might be necessary to abandon a large part of the proposed plant, the preamble points out, since "caustic sewage cannot readily be treated" biologically.

It is understood that the City of Austin has not yet signed a contract for the proposed direct-oxidation plant but is to delay action until information can be had on the outcome of the tests of the process being made at Toronto under the direction of F. A. Dallyn, engineer, Ontario Board of Health.

Report on Rapid-Transit Lines for Detroit

Local Benefit Assessments Proposed to Pay for Most of System—Alternative Plans

Reporting on rapid transit in Detroit, the city's rapid-transit commission (Daniel L. Turner, consulting engineer) has just advised the Mayor that the cost of a complete system will be so great as to make the solution of the financial problem the primary consideration, but that a complete system should be built, rather than individual lines as piecemeal items of a system, since the latter increase congestion and unbalanced city growth. The commission presents a plan for financing construction which would provide the larger amount of the required capital by local-benefit assessments, a smaller part by general taxation, and the capital for equipment by a bond issue. It indicates that either an underground system or a system largely elevated with short underground portions near the center of the city might be built, and states that a decision of which kind of system is to be built should be reached before a plan of routes is developed. The underground system would be more costly that the elevated but is otherwise preferable. The report does not in terms recommend either system. It says:

"The routes of the initial rapid-transit system for Detroit are dependent to some extent upon the type of structure. An underground system may be constructed along any street without injuring it. Elevated lines should be confined to the outlying sections of the city, but if such construction must be carried through the business centers the principal thoroughfares should be avoided and less important streets traversed."

UNDERGROUND SYSTEM

For the underground system, a new method of construction is recommended, called the "tunnelway" system. This would have its main portion constructed by tunneling, at sufficient depth to avoid service structures near the surface, but the stations would be placed at summits of the line and would be constructed by excavation direct from the surface. Such a system is estimated to cost $3,200,000 per mile of double-track structure, and $1,500,000 per mile for equipment, a total of $4,700,000. The financial plan recommended would raise $800,000, or one-fourth of the cost by general assessment on the city, and $2,400,000, or three-fourths of the cost, by local assessment. The $1,500,000 equipment cost would be met by mortgage bonds. An elevated system, with underground construction in the center of the city could be built for $3,500,000 per mile, it is reported, $2,000,000 of this amount being cost of structure. "Detroit can have a tunnelway system," the report states, "if it wants to pay the price. Otherwise it must accept an elevated system, with all the disadvantages that such a system means.

The present bonding power of the city is said to be not over $30,000,000, and of this amount only a small part would be available for rapid transit construction. This is the basis for the financial plan proposed by the commission. Local benefit assessments, the report recommends, would be spread over the land a half-mile either side of lines.

Cleveland Names City Manager

At its meeting called especially for the purpose, city council-elect of Cleveland, Ohio, last week elected William Rowland Hopkins as the city manager for that city. Mr. Hopkins will take office on Jan. 8 next. Meanwhile council will meet to fix the manager's salary, which is unofficially quoted as being near $25,000 a year.

Mr. Hopkins, who is best known as an attorney interested in engineering development and municipal problems, is 54 years old. He was born in Johnstown, Pa., but went to Cleveland with his family as a child.

He is a graduate of Western Reserve University. His chief work for Cleveland has been in promoting the belt-line railroad.

Cornell to Hold Highway Conference

A conference on highway engineering is to be held at Ithaca by the Bureau of Highways of the New York State Department of Public Works, Dec. 18-20, under the auspices of the school of civil engineering of Cornell University. The program for the conference includes papers upon all phases of highway engineering and transport.

During the first day speakers will include Col. Frederick Stuart Greene, New York, H. E. Hilts, Pennsylvania State Highway Department, Clifford Older, chief engineer of the Illinois Bureau of Highways; Harley C. Dunbar, assistant engineer of the New York State Bureau of Highways, and A. T. Goldbeck, of the Division of Tests of the U. S. Bureau of Public Roads. The first day's program will end with a smoker at which speakers will include Dean D. S. Kimball of the College of Engineering at Cornell, Dean W. A. Hammond of the University Faculty and Lowell Grossman, Commissioner of the Bureau of Highways in New York.

Traffic studies and regulation, and pavement maintenance will feature the second day's session. J. Gordon McKay, chief of the Division of Highway Economics and Transport, U. S. Bureau of Public Roads; John A. MacDonald, commissioner of highways, of Connecticut; Julius Adler, deputy engineer of the Bureau of Highways of Philadelphia; William A. Van Duzer, transport engineer of the Pennsylvania Highway Department; A. W. Brandt, second deputy of the New York State Bureau of Highways and Paul M. Tebbs, field engineer of the Pennsylvania Highway Department, will be the speakers.

The feature of the third day's session will be the conference of division and county engineers of the New York State Bureau of Highways. This conference is usually held at Albany. Previous to this conference, which will be held the afternoon of Dec. 20, "Essentials of Highway Construction" will be discussed by Theron M. Ripley, division engineer of the Bureau of Highways, New York; "Proper Relation Between Engineers and Contractors," by Roy Hall, division engineer of New York Highway Department, and "Snow Removal," by Frank F. Rogers, commissioner of highways of Michigan.

Random Lines

Explaining Osteopathy

Osteopathy is a new kind of therapeutics, separate from, and independent of the system of medicine. It covers in its comprehensive view the whole field of practice, including surgery and obstetrics, in which it has had signal success. It is more than manipulation. It is really adjustment. While the hands are used, it is not this alone and chiefly that constitutes its method of operation. *It is engineering, in the highest sense.* It is above the plane of "movements"—for there are no movements—no more than in bridge-building. The great principles of construction and production, the efficient action of multitudinous parts dependent on construction, the establishment of complicated processes in an interminable circle of causes and effects, all issuing in one united result—health—all these underlie the osteopathic idea of adjustive manipulation. — From "Osteopathy as Explained by The Encyclopedia Americana."

* * *

The Latest Batch

"The Magnetic House Cleaning Engineer"—Advertised in the Satevepost.

"Surface Protection Engineers"—Frederick J. Cadmus, Jr. & Co., painters and cleaners of Detroit.

"Social Engineers"—Dr. Henry Jackson, formerly pastor of the Swarthmore Presbyterian Church, at Swarthmore, Pa.

"Milk Engineers"—Majonnier Bros. Co. in the Chicago classified telephone directory.

"Feed Plant Engineers"—S. T. Edwards & Co., also in Chicago telephone directory.

* * *

More Polar Determination

Sir—The instance of animal magnetism which you give in this column in your issue of Nov. 22 is very good. There is another instance, however, but no date is attached. Three Scotch sailors were caught in the fog off the coast and could not get their direction. Finally a piece of canvas was smoothed out, each man holding a corner. Then the national bird was produced from the bared breast of one patriot. It was flung onto the sail cloth, landing on its back, but it soon righted itself, crawled about in a circle and then struck off to port. Jock pointed in that direction and said: "Well, I'll no be for telling the north but there's the direct route to Scotland."

C. R. C.

* * *

The New Botany

ST. CLAIRESVILLE, OHIO, Oct. 26.—A deed sent here for recording the sale of a farm near Bridgeport gives the starting point for the surveyor's description of the acreage as a "mahogany tree." (PRESS CLIPPING.)

Private Capital to Develop Falls of the Ohio

Washington Correspondence

Following the recommendations of its engineers that private capital be allowed to develop the power in the Falls of the Ohio near Louisville in preference to having it developed by the city of Louisville (*Engineering News-Record*, Aug. 30, 1923, p. 362), the Federal Power Commission has issued a preliminary permit to the Louisville Hydro-Electric Co. covering this site. In line with this action, the commission has also denied the application of the City of Louisville for a preliminary permit covering proposed developments on the Cumberland and Green Rivers. The decision in the Falls of the Ohio case has been pending for a long period, while the commission considered the priorities which are allowed to municipalities under the water power act, and while it carried out an investigation as to whether municipalities are in a position to conduct the distribution and sale of power in areas outside of their jurisdiction.

The engineers in their report pointed out that in order to make this development effective, the municipality would have to construct a steam plant and distributing system as an auxiliary to it, which plant and distributing system the Louisville Hydro-Electric Co. already has available.

Last Section of Hetch Hetchy Tunnel Holed Through

The last section of the 18-mile tunnel on the Hetch Hetchy project, San Francisco's future source of water supply, was holed through on Nov. 26, 2,180 ft. east of Second Garotte shaft. This section is three miles long and extends from Second Garotte shaft to Big Creek shaft, from which points the two headings were advanced. The headings met with a grade discrepancy of 0.94 ft. and a difference in alignment of 0.25 ft.

At present the concrete lining of the Hetch Hetchy tunnels is being placed at only one point, but lining will be under way with two complete equipments at an early date. With one plant pouring two 8-hr. shifts and moving plant the third, the present progress is about 120 ft. per day, pouring sides and arch which contain a total of about 1¼ cu.yd of concrete per lineal foot.

On Dec. 1 the construction crews in the mountain division on the Hetch Hetchy project totaled about 1,200 men.

Canadian Institute to Meet

Announcement has just been made that the annual meeting of the Engineering Institute of Canada is to be held in Ottawa, Wednesday and Thursday, Jan. 23-24. The general meeting is to be convened at Montreal on the morning of Jan. 22, but the session there that day will be merely for the purpose of appointing officers and nominating scrutineers to count the officers' ballots. The regular sessions start the next morning at the Chateau Laurier in Ottawa. Wednesday will be devoted to reports of committees and to papers, with a banquet and smoker (somewhere in Quebec) in the evening. Thursday morning will be devoted to professional meetings with a visit to the Rideau Canal in the afternoon and a ball in the evening.

Engineering Societies

Calendar

Annual Meetings

FEDERATED AMERICAN ENGINEERING SOCIETIES. Washington, D. C.; Annual Meeting, Washington, D. C., Jan. 10-11, 1924.

AMERICAN ROADBUILDERS' ASSOCIATION, New York City; Annual Convention, Chicago, Jan. 14-18, 1924.

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York City; Annual Meeting, New York, Jan. 16-18, 1924.

ASSOCIATED GENERAL CONTRACTORS OF AMERICA, Washington, D. C.; Annual Meeting, Chicago, Ill., Jan. 21-24, 1924.

ENGINEERING INSTITUTE OF CANADA, Montreal; Annual Meeting, Montreal, Jan. 22, and Ottawa, Jan. 23, 24, 1924.

AMERICAN CONCRETE INSTITUTE, Detroit, Mich.; Annual Meeting (20th anniversary), Chicago, Ill., Feb. 25-28, 1924.

The Engineers' Society of St. Paul has voted to enter the Federated American Engineering Societies. Grover H. Wilsey, editor of the bulletin of the Affiliated Architectural and Engineering Societies of Minnesota, has been elected representative of the St. Paul society.

The Municipal Engineers of the City of New York had an illustrated lecture by Philip P. Farley, consulting engineer, New York City, on the Coney Island Public Beach and Boardwalk Improvement at their meeting Nov. 28.

The Engineers' Club of Kansas City, Mo., will hold its annual meeting Jan. 31, with a dinner dance as the social feature. A. C. Everham is president of the club, and Fred Johnson is secretary.

The Montreal Branch of the Engineering Institute of Canada at its meeting Dec. 6 enjoyed an illustrated lecture on "Irrigation in Brazil," given by Ira W. McConnell, vice-president of Dwight P. Robinson & Co., Inc., of New York City.

The Scientech Club of Indianapolis announces the nomination of the following officers for 1924: Earl Carter, president; D. J. Angus, vice-president; J. L. Wayne, secretary; and Arthur Hood, treasurer. The date of the annual election is Dec. 17.

The Albany, N. Y., Society of Engineers at its annual meeting Dec. 18 will have an illustrated talk on "Siphon Spillways" by George F. Stickney, consulting engineer, Albany, N. Y. Walter N. Mansfield is president of the society, and John W. Henry is secretary-treasurer.

Personal Notes

THOMAS H. MEANS, consulting engineer, San Francisco, and a member of the firm of Cope Rand Means Co., has been appointed consulting engineer of the Banta-Carbona Irrigation District in San Joaquin County, California. Mr. Means, after graduation from Columbia University and service in the U. S. Department of Agriculture in irrigation and drainage study in France and Africa, was connected with the U. S. Reclamation Service, and later in private practice. He was engineer in charge of maintenance and operation on the Truckee-Carson project, consulting engineer of the Anderson-Cottonwood Irrigation District, and engineer on many soil surveys and irrigation investigations.

HENRY Z. OSBORN, Jr., who has been chief engineer of the Board of Public Utilities, Los Angeles, Calif., has opened an office in the Pacific Finance Bldg., Los Angeles, for consulting engineering practice. Mr. Osborn was formerly engineer of the street planning department of Los Angeles and chief deputy in the city engineer's department.

FRANK A. RAVEN has tendered his resignation as superintendent of public works of Albany, N. Y., a position he has held for two years, in order to return to consulting engineering work. Mr. Raven for many years has been consulting engineer for the Albany Felt and Ludlum steel companies.

R. STUART MCKENZIE, of Montreal, has been appointed consulting engineer to the Dominion Engineering & Inspection Co. of Montreal. Mr. McKenzie graduated from McGill University in 1901 and joined the engineering staff of the Canadian Pacific Ry. as chief draftsman in the bridge department. In 1910 he was appointed assistant engineer of bridges for the Grand Trunk Pacific Ry. At the end of two years he entered private practice as a consulting engineer, specializing in foundations and hydro-electric work. In 1920 Mr. McKenzie became associated with the Dryden Paper Co. as construction engineer, and designed, and built the hydro-electric plant at Eagle Ruin, Ont. Later, for the Manitoba Power Co. he was field engineer on the 168,000-hp. hydro-electric development at Great Falls, on the Winnipeg River. Mr. McKenzie has been a member of the council of the Engineering Institute of Canada.

LOUIS BROWNLOW, for several years city manager of Petersburg, Va., has been appointed city manager of Knoxville, Tenn., and will take up his new work Dec. 15.

C. C. COTTRELL, manager of the Good Roads Bureau of the California State Automobile Association, has resigned to become chief engineer of the Western Willite Co., paving contractors, and will make his headquarters in Los Angeles. Mr. Cottrell has given valuable aid in promoting highway progress in California, having urged the conclusion of the controversy between the Victory and Lincoln highways and the designation of the Victory route in southern California, which also assures the completion of the Wendover cutoff. He was active in securing road revenue legislation abolishing the horsepower tax and substituting a nominal registration fee and two-cent gasoline tax. Mr. Cottrell was superintendent of highway construction and maintenance for the state of California from 1913 to 1917, assistant state highway engineer of Nevada for a time and state engineer of Nevada from 1918 to 1920. In Nevada he was responsible for the construction of 225 miles of highway.

From the Manufacturer's Point of View

A Point of Contact Between Maker and User of Construction Equipment and Materials

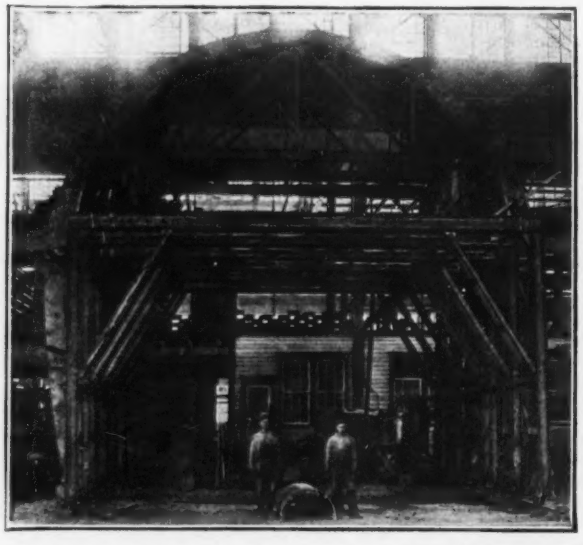
Interviews with Industrial Executives—3

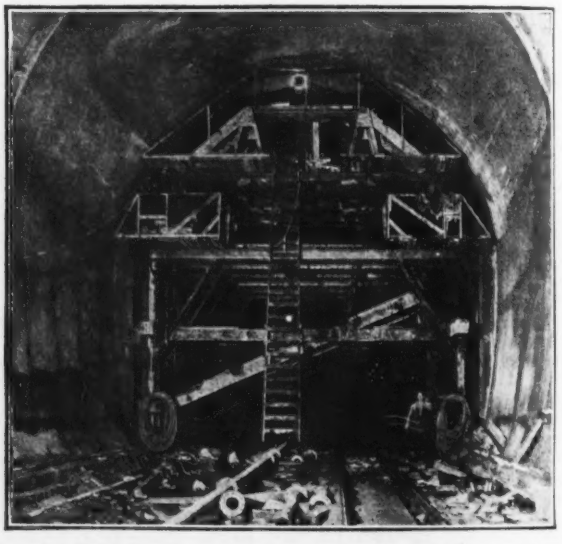
Service Policy Aims at Proper Selection and Use of Steel Forms

This is the third of a series of "Interviews with Industrial Executives" in which Albert C. Lehman, president, Blaw-Knox Co., Pittsburgh, relates how the contractor is helped before work starts and while it is in progress.

The fourth interview will appear in an early issue.—*Editor*

AS A means of enabling contractors and engineers to get the best results from the construction plant they purchase the Blaw-Knox Co., Pittsburgh, manufacturer of steel products including forms for concrete, portable buildings, storage and measuring bins, and clamshell buckets, has set up a policy of service both before and after the sale of its equipment. This means, first, studying the work to be done and adapting the equipment to it, and, second, making the equipment function on the job to produce the best results. The details of this twofold obligation which the company has assumed are set forth in the following notes based on information *Engineering News-Record* has secured from Albert C. Lehman, president of the manufacturing organization:





TO INSURE PERFECT OPERATION ON THE JOB LARGE STEEL FORMS ARE ERECTED AT COMPANY'S SHOPS BEFORE SHIPMENT

Traveling forms for concreting 32-ft. tunnel, Niagara Falls Power Co.

"All the men who represent the Blaw-Knox Co.," Mr. Lehman explained, "sell service first and equipment second. We feel that service has the same large value to our customers as to ourselves. Consequently our service begins prior to the sale, continues while the equipment is being manufactured, and does not cease until the customer has practically finished his work."

PLANT LAYOUT STUDIED

Mr. Lehman was asked to amplify his statement concerning service prior to the sale of equipment.

"In the construction field," he replied, "our company supplies contractors not only with steel forms but also with overhead material-measuring bins, known as batcherplants, and clamshell buckets. In approaching a customer, therefore, our sales engineer is concerned not with a single detail of plant but with the contractor's general plant layout and the possibility of adapting our equipment to his needs. We often find it possible to make useful suggestions regarding the best combination of equipment for handling the work at the least cost and in the minimum time. The service-before-the-sale, therefore, may take the form of revamping the contractor's ideas about his general scheme of construction.

"In most large engineering projects there is, as a rule, no initial consideration given to the steel forms the contractor will use in his concreting work. There are in his mind, however, very definite ideas as to the results expected from the forms. This condition makes it necessary for the manufacturer's sales engineer to be able to analyze the customer's specifications, and, in consultation with him, plan equipment which will absolutely meet the conditions of the work to best advantage."

After the sale has been consummated, Mr. Lehman explained, the company renders service to its customers by erecting the equipment in its own shop prior to shipment. In this way the field work is reduced to a minimum and there is no question as to shop workmanship. This is a service, it is claimed, which the average purchaser of steel forms or similar equipment which is dismantled and shipped knocked down, does not usually appreciate. This is true particularly of equipment designed to meet special conditions and where substitution for parts that do not fit is impossible.

ADVICE ON FORM ERECTION

At the time of delivery of steel forms to contractors the Blaw-Knox Co. furnishes complete erection drawings. An experienced erection engineer is also sent to the job to give the contractor such assistance as he may require in setting up his forms and getting proper results from them. This service man is kept on the job until the steel forms are performing in a manner satisfactory to both purchaser and manufacturer.

'As construction progresses," Mr. Lehman continued, "we revisit the job from time to time to see that the contractor's workmen are handling the plant economically and safely. We check up on the number of men working on a job and sometimes are able to point out to a contractor that his costs are higher than they should be. Our interest in the steel forms for concrete work does not cease until the job is completed."

ACCESSORY EQUIPMENT

The same sort of service that is given on steel forms for concrete construction is rendered for clamshell buckets and batcherplants. In the case of the buckets, the company stresses the importance of proper rigging in order to secure smooth working and maximum capacity. In the case of the batcherplants it is essential at the start to have the equipment erected properly.

"From a purely selfish standpoint," Mr. Lehman concluded, "it is profitable to any manufacturing company to give

Japan Will Be Heavy Buyer of Equipment and Materials

American Manufacturers Urged to Prepare Sales Campaigns for Demands Under Permanent Reconstruction Plans

Active buying of materials and engineering equipment under the Japanese permanent plan of reconstruction is expected to start early next year according to Luther Becker, chief of the Iron and Steel Division of the Department of Commerce, who urges American manufacturers to prepare their sales campaigns now "if they are to reap the full advantages of the opportunities offered." Next spring should see unusual activity in the Japanese trading market says Mr. Becker and these precautionary measures are urged in view of the keen interest and active preparation of our foreign competitors, noticeably the British and German.

"American manufacturers," said Mr. Becker, "are strongly intrenched in the minds of the Japanese trader and consuming public because of the good-will established during the war when their products for the first time gained wide recognition and approval. Our modern steel and ferro-concrete buildings proved their worth when they came through unscathed in the recent catastrophe at Tokyo, and to the Japanese people will stand as monuments to the fame of American practice and quality. It therefore obligates the American producer to back up this well earned reputation and come forward at this time of urgent need to co-operate with the Japanese in restoring their cities and factories,"

RECONSTRUCTION PROGRAM

The reconstruction program for Japan involves two distinct phases the temporary and the permanent, the first of which has gotten underway. Because of the necessity for quick action in housing the homeless community during the coming winter the Government, through its Reconstruction Board, authorized the purchase of building materials that can readily be converted into cheap temporary buildings. In accordance with this plan the Japanese government has placed several orders in America and England for lumber and steel products and it is believed that additional orders will be placed in the United States.

Out of the deliberations and conclusions of the Diet Dec. 10 will come a permanent program which in interest and from the standpoint of trade value of the requirements for materials and plant equipment for reconstruction will far surpass, the Department of Commerce predicts, what has already been accomplished towards providing temporary relief. A permanent building code will have been evolved which will determine the types and size of buildings, kinds and quality of materials, more economical and efficient methods of construction, and fire-preventive measures.

For the larger buildings—government and municipal, office, hotel, bank and theater—use will be made, according to the Commerce Department, of the steel-frame and reinforced-concrete types of construction, which best withstood the unprecedented shocks by earthquake on Sept. 1 and the fires which followed. The relative high costs of steel and concrete construction in Japan will prohibit the adoption of these types for the ordinary native house.

the best it has in the way of information and guidance to its customers. The equipment manufacturer wants the user to make money; it wants him to use his equipment properly. The reaction from a policy of this sort is bound to be favorable to the company following it. In addition, the manufacturer benefits by bringing in from the field, through visits of his service men, ideas that may be utilized in future designs of equipment. By rendering service to contractors, therefore, we ourselves are taught real lessons in construction work and in the design and operation of the equipment with which it is carried on."

More Bidding Time Needed

Manufacturers of equipment endorse C. G. Richardson's complaint (see "Engineering News-Record," Nov. 8, p. 783, and Nov. 22, p. 866) against necessity of hurried preparation of estimates on proposed work.

Elevating and Conveying Machinery

BY F. E. VAN SLYKE

Jeffrey Manufacturing Co., Columbus, Ohio

IN MANY CASES we have to refuse to quote on municipal equipment due to the short time allowed in which to prepare a proposal. Municipal engineers usually work out very elaborate specifications which do not always correspond to standard equipment supplied by various manufacturers. This often means alternate proposals, one in accordance with the engineer's specifications and one in accordance with the manufacturer's specifications. Then again, these proposals usually have to go through certain routine and a certified check must be furnished in every case. This all takes time and the four weeks mentioned could be extended, with advantage to all concerned, to six or eight weeks from the time the bids are mailed until the proposal is to be closed.

From the manufacturer's viewpoint a hastily prepared proposition can not be absolutely accurate in all details and a lot of guessing has to be done in arriving at a final price unless ample time is provided to figure out all of the details. On the other hand, the short time sometimes allowed prevents many manufacturers from even submitting a bid, as it is considered hardly worth while in view of the time limit.

From the purchaser's viewpoint a too short time means that they may not get the best possible equipment, as only a few bidders will go into the proposition. If the time had been lengthened they would probably have two or three times as many propositions, with ample time to give them all consideration.

Filter Plant Equipment

BY H. W. HOSFORD

Norwood Engineering Co., Florence, Mass.

OUR attention has been called to Mr. Richardson's article in your Nov. 8 issue (p. 783) in reference to the shortness of time allowed manufacturers to prepare bids for municipal waterworks equipment. We wish to endorse Mr. Richardson's views in this matter.

We manufacture and install equipment for mechanical rapid sand filtration plants. In a great many cases the engineer specifies that prospective bidders are to furnish detail drawings of their standard equipment, properly arranged to fit the proposed lay out. Many times the time between the advertising of the bids and the date set for receiving them is so short that it is impossible to do this. As stated by Mr. Anderson of the Chapman Valve Manufacturing Co. (see *Engineering News-Record*, Nov. 22, p. 866), there are many cases requiring special equipment on which we have to obtain prices from other manufacturers, which we are unable to do for the reason stated above.

Only recently we had occasion to bid on three different plants located in widely separated parts of the country, bids for two of which were received exactly the same day, and the third one on the following day. We had less than ten days to prepare all three bids. Needless to say, we were unable to bid on all of these jobs.

We believe that the engineers as well as the municipalities are desirous of obtaining as many competitive bids as possible on their work, and we cannot urge too strongly the advisability of allowing the different manufacturers more time in which to prepare their bids.

Last Call!

MANUFACTURERS: Preparation of "Engineering News-Record's" Annual Editorial Review of Machinery and Materials—to appear in the first issue of the New Year—has begun.

If you have not already sent us a brief statement covering the outstanding improvements made in your products during 1923, it is requested that you do so at once. Otherwise the Review may omit adequate mention of your organization's contribution to the year's progress.—Editor.

Business Notes

PAWLING & HARNISCHFEGER CO., Milwaukee, manufacturer of excavators, cranes and machine tools, has recently appointed R. P. McCormick as Eastern sales manager with offices at 50 Church St. New York, and Stephen-Girard Building, Philadelphia.

NATIONAL STEEL FABRIC CO., Pittsburgh, has appointed H. D. Beaton Eastern manager, with headquarters in the Harrison Building, Philadelphia. Other recent appointments are those of W. L. Whitman as district manager, with offices at the Philadelphia address above referred to, and of C. S. Reno as district manager in charge of the company's office and warehouse at 523-5 West 33rd St., New York.

B. F. STURTEVANT CO., Boston, announces the opening of its new plant in Camden, N. J., to which the former Philadelphia division has been transferred. The new works include modern daylight shop buildings for the manufacture of sheet metal work involved in heating and ventilating equipment.

PORTLAND CEMENT ASSOCIATION, at its annual meeting in New York Nov. 21, elected the following officers: President, F. W. Kelley, Helderberg Portland Cement Co., Albany, N. Y.; first vice-president, Blaine S. Smith, Universal Portland Cement Co., Chicago; second vice-president, L. R. Burch, Atlas Portland Cement Co., New York; treasurer, John W. Boardman, Huron Portland Cement Co., Detroit. W. M. Kinney continues as general manager of the association.

FRANK H. DEWEY, for two years sales engineer of the Wood Hydraulic Hoist & Body Co., Detroit, has been made assistant general manager. He was connected with the Horizontal Hydraulic Hoist Co., Milwaukee, until that organization was absorbed by the Wood company.

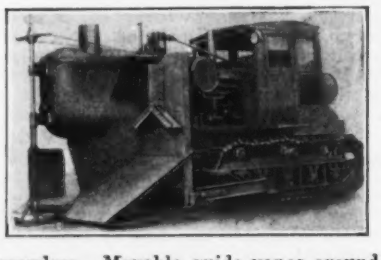
Equipment and Materials

Twin Rotary Snow Plow

For clearing snow from highways, Monarch Tractors, Inc., Watertown, Wis., is manufacturing from designs prepared by its chief engineer, A. C. Webb, a twin rotary plow mounted on the front end of a tractor, as shown in the accompany photograph. With other types of plow, the manufacturer states, there is a tendency, under certain conditions, to build up a wall of snow on either side of the roadway, forming a canyon out of which it becomes difficult to plow snow as winter progresses. The rotary plow, however, is designed not only to move the snow from the highway, but to throw it far to one side by means of a pair of revolving three-vane fans.

The Monarch rotary snow plow weighs about 4,500 lb., is 8 ft. in width, and is a self-contained unit powered by a Beaver heavy-duty industrial motor. The two heavy steel fans shown in the illustration are chain-driven at a speed of 350 r.p.m. Each fan can be disconnected independently by means of a twin-disk clutch. The fans run on Timken roller bearings.

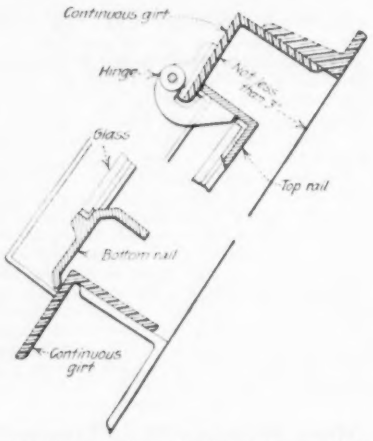
The front shoe and rudder of the plow are designed to assist in steering, but the plow can be controlled by the tractor through push bars attached to the



crawlers. Movable guide vanes around the fan control the height and distance to which snow is thrown sideways.

Steel Sash Improvement

A recent improvement in continuous sash for factory and industrial buildings has been introduced by the David Lupton's Sons Co., Philadelphia, in the form of a new section of bottom rail for the Pond type of sash. In this new construction the bottom rail has its



outer face flush with the glass, so that water will run off freely when the sash is open. In the earlier design the rail had a horizontal flange on the outside and drip holes in this flange were depended upon to prevent pocketing of water when the sash was open and the flange therefore inclined downward. These drip holes would clog occasionally, retaining the water so as to cause corrosion of the steel. This condition is avoided in the new design.

One-Man Earth Mover Has Power Supplied by Tractor

Designed for use with a shovel, a ditcher or a crane attachment, the earth-mover shown in the accompanying

illustration has just been announced by the Insley Manufacturing Co., Indianapolis, and will make its initial appearance at the Good Roads Show in Chicago next month. The equipment is powered by a Fordson tractor and is intended as a one-man machine of low first cost as compared with other types of excavating equipment employed by road contractors, quarry operators and material-handling organizations.

By varying the attachments the machine may be made to serve as a ¾-yd. shovel, a ½-yd. ditcher or a ¾-yd. clamshell bucket outfit.

Skip-Guard on Paving Mixer Prevents Accidents to Loading Crew

To prevent accidents to the crew on the loading end of mixers for concrete road construction the Chain Belt Co., Milwaukee, has developed an automatic skip-guard for its Rex pavers. Most of these accidents have been due to the lowering or falling of the loaded skip which, in the case of the 21-E machine, has a weight when loaded of 2½ tons.

The automatic guard, illustrated herewith, consists of a strong pipe framework securely fastened to the lower main frame of the paver and completely encircles the loading skip. It is automatic in its action. When the skip is on the ground this guard rests on the ground and in no way interferes with the loading of the skip. As the skip is elevated the guard rises with it until

the guard attains a breast-high position, or a distance of 3½ ft. from the ground. At this point it stops and prevents any workmen around the skip from inadvertently getting under the skip while it is in its elevated position. As the skip returns to the ground for the next batch it lowers the skip-guard with it.

An effort is now being made to secure from liability insurance boards a reduction in premiums to users of the safety skip-guard.

Publications from the Construction Industry

Electric Motors—RELIANCE ELECTRIC & ENGINEERING CO., Cleveland, in a 32-p. vest-pocket size illustrated booklet, offers some useful suggestions on how to select, install, and use electric motors.

Tractors for Snow Removal—HOLT MANUFACTURING CO., Peoria, Ill., has published a 16-p. illustrated pamphlet featuring the applications of its caterpillar tractors, equipped with plows, for removing snow from rural highways and city streets. The tractors are shown operating both with blade and with wing type plows. A point is made of the all-year-round usefulness of the tractor. It may be employed for snow removal in winter and for road building and general industrial haulage at other times.

Business Side of Construction

FACTS AND EVENTS THAT AFFECT COST AND VOLUME

Production and Materials Stocks in Ten Cities

Drop in Iron, Steel, Brick and Lumber Output—Cement Production Increasing—Dealers' Stocks Ample

Iron and Steel—Over 2,894,000 tons of pig iron were produced during November, against approximately 3,125,000 during the preceding month. The present rate is about that of the corresponding period in 1922.

The steel ingot output reached 2,969,012 tons during November, according to the American Iron and Steel Institute. October production totaled 3,382,986 tons and September 3,161,964, compared with 4,000,695 tons during May, which was the heaviest month of the year.

Lumber—The trend of the lumber movement of the country indicates a decided drop in production and shipments and a slight falling off in demand. The lumber movement, according to the National Lumber Manufacturers' Association, is shown in the following table:

	Four Weeks Ending	
	Dec. 1 ft. b. m.	Nov. 3 ft. b. m.
Cut	1,032,746,118	1,071,142,679
Shipments	939,826,553	986,126,293
Orders ...	903,601,237	920,159,103

Production is now about 2 per cent above normal, with orders 98 per cent and shipments 92½ per cent of normal output. Production, shipments and orders for the four weeks ending Dec. 1, show declines compared with the preceding four weeks, and heavy gains over the corresponding period last year.

Cement—Production during the first ten months of the current year totaled 114,366,000 bbl., against 93,850,000, for the corresponding period in 1922, according to the Geological Survey. With a gain of 22 per cent in production and 17 per cent in shipments, compared with a year ago, a total of 4,597,000 bbl. were available, as a reserve stock for the nation, on Nov. 1, as against 4,149,000, on hand one year ago.

Brick—The report of the Common Brick Manufacturers' Association of America, as of Nov. 1, shows 306,922,000 burned brick on hand at yards throughout the country, compared with 307,633,000 for the month preceding. Many plants are closing down owing to seasonal conditions and during October the output was 163,000,000 brick with shipments at about 145,000,000. Stocks are being accumulated with the expectation of an active demand at the resumption of greater building activities in the spring. Aggregate orders on books have decreased about 8 per cent during the last thirty days, while actual increases in demand are noted in the East and Middle West. The shrinkage in orders is confined to the smaller centers, especially those in agricultural territories.

San Francisco—Stocks of building materials fairly large, with the exception of structural rivets and blue annealed steel sheets.

Los Angeles — Dealers behind on sewer pipe orders. All cement and lime plants active. Brick and tile demand steady and well supplied. Great quantities of lumber arriving at harbor from North Pacific coast. Supplies of all other materials sufficient to meet requirements.

Denver—Hollow tile and sewer pipe stocks low; other materials plentiful.

Minneapolis — Dealers report stocks of building materials ample in all lines, either as in local yards or warehouses or readily obtainable on short notice from nearby mills.

Detroit—Sewer pipe stocks decreased slightly during month; ample supply in local yards for present needs. Small stocks of hollow tile on hand; large deliveries require several days.

Chicago—Sewer pipe production just enough to satisfy small current demand. Stocks of all other materials ample.

Cincinnati—Sufficient dealers' stocks to take care of present demand.

New Orleans — Pine lumber stocks light; demand slow. Supplies of other materials fair; demand good.

Philadelphia—Small but ample stocks of sewer pipe. Hollow tile mill deliveries prompt, although dealers'

CONDITIONS OF MATERIALS STOCKS IN IMPORTANT CENTERS

Stocks on hand in approximate figures, example: (Common brick, Denver, 9,000,000); time required for delivery of carload lots to city job, example: (Lumber, Chicago, 30 @ 60 days); and stocks on hand in general terms, example: (Hollow tile, Cincinnati, plenty.)

	San Francisco	Los Angeles	Denver	Minneapolis	Detroit	Chicago	Cincinnat	New Orleans	Philadelphia	New York
Sewer pipe.....	Stocks in good shape	Dealers behind with orders	Supply low	Ample	Stocks decreased slightly	Production sufficient to meet small demand	Stocks large	Fair; demand good	Small, but ample	Sizes 15 to 36 in., double strength scarce
Cement.....	Fairly well supplied	All plants active	Enough	Plenty in local warehouses	Plenty at mills	Very good supply	Sufficient to take care of demand	Plenty; demand good	Sufficient	Plenty; dealers' stocks small but mill del. prompt.
Lime	Stocks in fair shape	All plants active	Sufficient	Enough	About 15 to 20 carloads in warehouses	Plenty	Enough	No shortage	Plenty	Market well supplied
Common brick.....	Large reserves	Demand well supplied	9,000,000	Plenty in local yards	Ample supply in local yards	Del. nearly on par with mid-building season	Ample	Sufficient	Well supplied	Del. nearly on par with mid-building season
Hollow tile.....	Stocks large	Meeting demand	Stocks low	Obtainable on short notice from nearby plants	Stocks small; large del. require several days	Slight drop in demand; stocks good	Plenty	Enough	Small stocks carried; del. prompt	Supply good; water deliveries prompt
Lumber.....	Plenty fir	Heavy shipments from North Pacific coast	15,000,000 ft.	Ample; demand kept up well	Moderate stocks in local yards	Del. take 30 to 60 days	Dealers' stocks sufficient to meet demand	Stocks light; demand slow	Yards well stocked	Mill del. very good; take 4 to 5 wks. from mill
Asphalt.....	Unlimited native reserves	Supplies meet steady demand	Sufficient	Enough	.....	Plenty	Ample	No market	Small demand; supply ample	Heavy reserves in N. J.
Structural steel.....	Plenty structurals; rivets and b. a. steel sheets scarce	Sufficient for requirements	Warehouses well stocked	Warehouse stocks ample	No shortage of local warehouse stocks	Fabricators' stocks of plain materials low	Demand small	Fair; good demand	Practically no dealers' stocks left; mill del. good	Structurals comprise bulk of demand

stocks are small. Warehouse stocks of structural steel very low; mill deliveries good.

New York—Brick deliveries in New York nearly on par with the mid-building season. Pine lumber mill deliveries very good; take only four to five weeks from mill. Hollow tile plants competing effectively with Western manufacturers on deliveries. Domestic building materials manufacturers have thus far been able to hold their own against foreign competition, by reason of a greater knowledge of the requirements of the local builders.

Bids Wanted on Big Jobs

Among the projects on which bids are either asked or will soon be called for, in Construction News, pp. 321 to 333, are the following:

Lock, Weston, Ky., U. S. Engineer, Louisville.

Factory, Toledo, O., Libby-Owens Sheet Glass Co., $1,000,000.

Disposal plant, Canton, O., $500,000.

Large Contract Let During Current Week

Among the week's announcements of contracts awarded in Construction News, pp. 321 to 333, is the following:

Factory, Amcelle, Md., to Austin Co., Philadelphia, Pa., $2,000,000.

Weekly Construction Market

THIS limited price list is published weekly for the purpose of giving current prices on the principal construction materials, and of noting important price changes on the less important materials. Moreover, only the chief cities are quoted.

Valuable suggestions on costs of work can be had by noting actual biddings as reported in our Construction News section.

The first issue of each month carries complete quotations for all construction materials and for the important cities. The last complete list will be found in the issue of Dec. 6; the next, on Jan. 3.

Steel Products:	New York	Atlanta	Dallas	Chicago	Minneapolis	Denver	San Francisco	Seattle	Montreal
Structural shapes, 100 lb.	$3.64	$4.00	+$4.40	—$3.30	$3.55	$4.20	$3.60	$4.10	$4.25
Structural rivets, 100 lb.	4.40	4.75	4.90	3.75	4.25	5.30	5.00	4.25	6.00
Reinforcing bars, ¾ in. up, 100 lb.	3.54	3.50	3.38	3.20	3.45	3.85	3.65	4.10	4.00
Steel pipe, black, 2½ to 6 in. lap, discount	44%	40%	43%	47%	53–5%	36%	33.2@42.2%	35%	47.43
Cast-iron pipe, 6 in. and over, ton.	—61.60@63.60	54.75	61.00	57.20@60.20	60.50	69.00	59.00	62.00	60.00
Concreting Material:									
Cement without bags, bbl.	2.55@2.65	2.35	2.05	2.10	2.42	2.84	2.61	2.90	2.25
Gravel, ¾ in., cu.yd.	2.00	1.75	2.38	2.00	1.85	1.90	2.15	1.25	1.50
Sand, cu.yd.	1.25	1.20	2.00	2.00	1.25	1.00	1.50	1.25	1.25
Crushed stone, ¾ in., cu.yd.	1.75	1.90	2.83	2.00	2.00	3.50	2.15	3.00	1.90
Miscellaneous:									
Pine, 3x12 to 12x12, 20 ft. and under, M.ft.	57.00	37.00	54.75	55.50	44.75@45.75	41.75	41.00	29.50	42.00
Lime, finishing, hydrated, ton	18.20	23.00	—20.00	20.00	25.50	24.00	22.00	24.00	21.00
Lime common, lump, per bbl.	3.00@3.25	1.50	1.85	1.50	1.50	2.70	2.10	2.80	9.50
Common brick, delivered, 1,000	22.55	11.00	11.60	11.00	16@18	12.00	15.50	15.00	16.50
Hollow building tile, 4x12x12, per block	Not used	.10	.11	.0724	.075	.065	.....	.11	.115
Hollow partition tile 4x12x12, per block	.1179	.10	.11	.....	.....	.065	.108	.11	.....
Linseed oil, raw, 5 bbl. lots, gal.	.95	—.95	+1.05	.94	+1.01	1.07	1.03	1.15	1.38
Common Labor:									
Common labor, union, hour	.75	.35	.....	.....	.....	.50@.55	.55	.62½	.....
Common labor, non-union, hour	....	.30	.30@.50	.82½	.50@.55	.35@.50	.50	.62½	.30

Explanation of Prices—Prices are to contractors in carload lots unless other quantities are specified. Increases or decreases from previous quotations are indicated by + or — signs. For steel pipe, the prevailing discount from list price is given: 45-5% means a discount of 45 and 5 per cent. Charge is 15c. per 100 lb. for cutting reinforced steel into 2-ft. lengths or over.

New York quotations delivered, except sand, gravel and crushed stone, alongside dock; common lump lime, in 280-lb. bbl. net, and hydrated lime f.o.b. cars; tile "on trucks"; linseed oil and cast-iron pipe f.o.b.

Labor—Concrete laborers' rate, 93½c.; building laborers (pick and shovel men) 75c. per hr.

Chicago quotes hydrated lime in 50-lb. bags; common lump lime per 180-lb. net. Lumber delivered on job.

Minneapolis quotes on fir instead of pine. Brick, sand and hollow tile delivered. Cement on cars. Gravel and crushed stone quoted at pit. We quote on brown lime per 180-lb. net; white is $1.80 for Kelly Island and $1.70 for Sheboygan. Common labor not organized.

Denver quotes on fir instead of pine. Cement "on tracks"; gravel and sand at pit; stone on cars; lime, brick, hollow tile and lumber on job. Tile price is at warehouse. Linseed oil, delivered, in iron bbl. Common lump lime per 180-lb. net.

Atlanta quotes sand, stone and gravel per ton instead of cu.yd. Common lump lime per 180-lb. net.

Dallas quotes lime per 180-lb. bbl. Steel, cement, cast-iron pipe and crushed stone f.o.b. cars, other materials delivered.

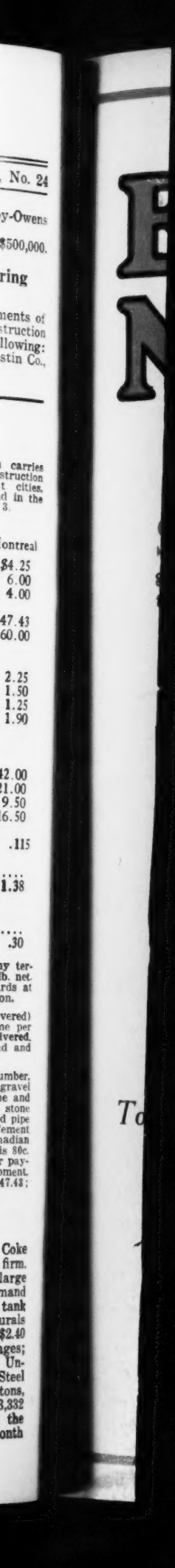
San Francisco quotes on Heath tile, size 5½ x 8 x 11½. Prices are all f.o.b. warehouses except C. I. pipe, which is mill price plus freight to railway depot at any terminal. Common lump lime per 180-lb. net. Lumber prices are to dealers in yards at San Francisco, for No. 1 fir, common.

Seattle quotes on Douglas fir (delivered) instead of pine. Lump finishing lime per 180-lb. net. Hollow building tile delivered. Hydrated lime in paper sacks. Sand and gravel at bunkers.

Montreal quotes on white pine lumber, free on cars at mill. Sand, stone, gravel and lump lime per ton. Cement, lime and tile are delivered; sand, gravel and stone on siding; brick f.o.b. plant; steel and pipe at warehouse. Hollow tile per ft. Cement price is in Canadian funds (the Canadian dollar stands at 97.47). Bag charge is 30c. per bbl. Discount of 10c. per bbl. for payment within 20 days from date of shipment. Steel pipe per 100 ft. net; 3-in., $47.43; 6-in., $119.

Changes Since Last Week

Unevenness continues to be the chief characteristic of the general market, particularly during the present inventory season. Few buyers are purchasing beyond immediate needs, and stocks of materials are being kept as low as possible. Production has fallen off in several of the basic commodities, particularly pig-iron and cotton goods. Increased activity, however, is noticeable in certain branches of the leather industry. Continued heavy car loadings indicate the handling of a vast amount of merchandise.

Few price changes occurred during the week in the basic building materials. Dallas reported an increase of 20c. per 100 lb. in steel structurals and 2c. per gal. in raw linseed oil. Minneapolis also quotes a rise of 2c. per gal. on linseed oil, due to lighter flaxseed receipts, the year's crop being about marketed. Chicago, however, reported a drop of 10c. per 100 lb. in structurals; Dallas, a decrease of $3.50 per ton in hydrated finishing lime and Atlanta, a decline of 1c. per gal. in linseed oil.

The iron and steel situation is briefly outlined as follows: Pig-iron sales smaller. No. 2 foundry iron $21@$22 per gross ton, Birmingham. Coke higher. Finished steel prices firm. Mills receiving inquiries involving large tonnages. Improved railroad demand for steel plates. Oil-storage tank plate requirements small. Structurals continue at $2.50 base, with $2.40 quoted on exceptionally large tonnages; bars, $2.40 per 100 lb., Pittsburgh. Unfilled steel tonnage of the U. S. Steel Corp., Nov. 30, totaled 4,368,584 tons, against 5,035,750, Oct. 31, and 7,403,332 on Mar. 31, 1923. March showed the heaviest unfilled tonnage of any month this year.